THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XX. No. 490—23RD YEAR.] LONDON, JULY 18, 1871. [Subscription per Annum. { 15s. in Advance. 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13½ cwt. coke per ton of coal.

RAMSAY'S PATENT CONDENSED COKE.

DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES. CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubitt Town. Large stocks kept.

Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,

Patentees of the Standard Gasometers for the Government, and of the

IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured.

To meet the increasing demand, G. GLOVER AND CO. have just entered on possession of extensive premises adjoining their present Works in Ranelagh Road, and they are now prepared to execute promptly, orders to any extent. They keep in stock all sizes of Meters up to 200 lights. In cases of haste, on the receipt of a telegram early on one day, their Meters can be delivered next day in any part of England, and in the large towns in Scotland.

Particulars and lists of prices forwarded on application to—

RANELAGH ROAD, PIMLICO, LONDON, S.W.;

236, GEORGE STREET, GLASGOW;

OR

15, MARKET STREET, MANCHESTER.

COWEN'S PATENT FIRE-CLAY RETORTS.

JOSEPH COWEN and CO.,

BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.

Coal Office,

QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.

JOHN RUSSELL and CO.,

THE OLD TUBE-WORKS,

CHURCH HILL, WEDNESBURY;

ALMA WORKS,

WALSALL, STAFFORDSHIRE;

and 69, UPPER THAMES STREET, LONDON,

Original Manufacturers of Wrought-Iron Gas-Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam-Boilers.

J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest orders may be executed in a few days.

Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps. Galvanized Tubes, &c.

N.B.—All goods thoroughly tested before sent out, and warranted.

JOHN BENT & SON,

WET AND DRY GAS-METER AND STREET-LAMP MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

ESTABLISHED 1830.

All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,

NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

London Agents: JAMES LAWRIE & CO., 63, OLD BROAD STREET, CITY, LONDON.

SCOTTISH CANNEL COAL.

J. & W. ROMANS, Consulting Gas Engineers and Coal Factors, of Edinburgh and London, CONTRACT for supplying any quantity of COAL and CANNEL.

They are also Contractors for leasing Gas-Works, for supplying, erecting, or repairing gas apparatus and fire-clay goods.

Messrs. ROMANS, being lessees of several Gas-Works, have their Cannels tested in the ordinary working process, thus securing for their customers a guarantee beyond mere laboratory experiments.

Analysis, prices, and other information will be forwarded on application to their Offices, 8, Forth Street, EDINBURGH; 1, Walbrook, Mansion House, LONDON, or to the "Crown Wharf," Thomas Street, Limehouse, LONDON, where stocks of house, steam, and gas coal are always on hand.

Coal, machinery, fire goods, &c., shipped to all parts of the world.

LESMAHAGO GAS COAL,

AUCHINHEATH COLLIERY,

LESMAHAGO N.B.

JAMES FERGUSON & CO.

LESSEES SINCE 1832.

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LA COUR & WATSON,

LEITH.

GEORGE GLOVER AND CO.,

Patentees of the Standard Gasometers for the Government,

TWO MEDALS,

LONDON, 1862.

HAVE OBTAINED THE

HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

IMPROVED DRY GAS-METERS AND GASOMETERS,

AT THE

PARIS EXHIBITION.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO LONDON, S.W.;

AND 236, GEORGE STREET, GLASGOW.

C. & W. WALKER'S

DOUBLE-FACED GAS-VALVES FOR LARGE MAINS.

These Gas-Valves for large bores are specially constructed of unusual strength and solidity. The Valve itself is a rigid wedge of cast iron, having two perfectly scraped surface facings, fitting between the two in the body, which are also surfaced. They are guaranteed absolutely tight under any chemical or other test for mains of the largest diameter, at a very moderate price.

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COOMBS WOOD PATENT TUBE-WORKS.

OLD HILL, near DUDLEY,

MANUFACTURERS OF

HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

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SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

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LONDON: No. 157, Upper Thames Street, E.C. **LIVERPOOL**: No. 63, Paradise Street. **MANCHESTER**: Barlow's Croft, Chapel Street, Salford. **PARIS and LILLE.**

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

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WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

CAST AND WROUGHT IRON GIRDERS, BRIDGES, AND ROOFS,

STEAM-ENGINE BOILERS, & GENERAL WROUGHT-IRON WORK.

London Agents: PORTER and LANE, 172, FENCHURCH STREET, E.C.

D. BRUCE PEEBLES & CO.,

ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,

BRASSFOUNDERS, & GAS APPARATUS MANUFACTURERS,

FOUNTAINBRIDGE WORKS, EDINBURGH.

SOLE MANUFACTURERS OF

Peebles' Patent Wet and Dry Gas-Meters in Tin-Plate Cases, with Tongue and Groove Joints.

IMPROVED WET METERS IN CAST-IRON CASES.

STATION-METERS, GOVERNORS, EXPERIMENTING METERS, PHOTOMETERS, PRESSURE-GAUGES, &c.

C. & W. WALKER'S GAS-VALVES.

These celebrated Valves of all kinds have been in use for so many years, and are so well known, that a description is unnecessary. They are made of all kinds to suit all the requirements of engineers.

Midland Iron-Works, Donnington, near Newport, Shropshire; 8, Finsbury Circus, London.

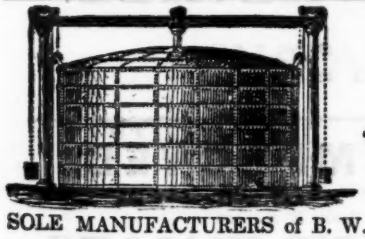
TO GAS COMPANIES, ENGINEERS, AND MACHINISTS.

NEW LUBRICATING OIL.

This Oil is suitable for every kind of machinery, being entirely free from anything liable to produce corrosion, and is equal in lubricating power to sperm or lard oil (though supplied at half the cost).

It is prepared in two consistencies—viz., LIGHT MACHINE OIL, for machinery where the pressure is moderate and the motion rapid. HEAVY MACHINE OIL, on machinery where the motion is comparatively slow. *Four-gallon Samples, carriage free, can included, for* £1 1*s.*

WALTER CARSON & SONS, Belle Sauvage Yard, Ludgate Hill, London, E.C.; 21, BACHELORS WALK, DUBLIN.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportacion.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

LONDON OFFICES—57, GRACECHURCH STREET, CITY.

*** *Please address letters to Huddersfield.*

REFERENCES TO NEARLY 300 GAS-WORKS.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

Possess special advantages for the prompt and efficient execution of large orders for

FIRE-CLAY RETORTS & FIRE-BRICKS,

Of every shape and size, and of the best quality; also for their *other productions* in Fire-Clay and Terra-Cotta, including their well-known White and Coloured GLAZED BRICKS.

The F. I. Co. have the exclusive right to make and sell Fraser's Patent "Ribbed" Retorts in Fire-Clay.

Apply as above, or at their Offices,

3, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W., or at 46½, QUEEN STREET, HULL.

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.

KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Bars, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

Agent in Ireland—Mr. JAMES FURNESS, No. 3, FOWNES STREET, DUBLIN.

1862.

PATENT ANTIMONY PAINT.

CLASS II.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

This Paint having been in general use over nine years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

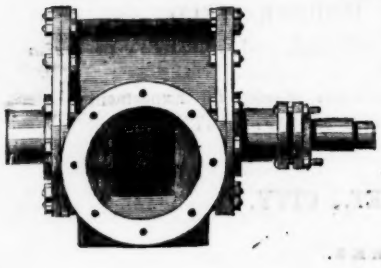
Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

BEALE'S GAS-EXHAUSTER IMPROVED.



FROM 250 TO 250,000 CUBIC FEET PER HOUR.

Since Mr. BEALE'S retirement, the Oldest Makers are

J. BURTON, SONS, AND WALLER,

MAKERS OF ENGINES, MACHINERY, and IRONWORK for GAS-WORKS.

Efficient and durable TAR, LIQUOR, and SYPHON PUMPS.

GAS-VALVES in stock, 2 inches to 30 inches.

SELF-ACTING BYE-PASS VALVES, with Lid and Relieving Lever,

ROTATORY, TUMBLER, and CAPILLARY WATER DISTRIBUTORS for SCRUBBERS.

EXHAUSTERS from 3000 to 30,000 per hour in stock.

HOLLAND STREET, BLACKFRIARS, LONDON, S.E.

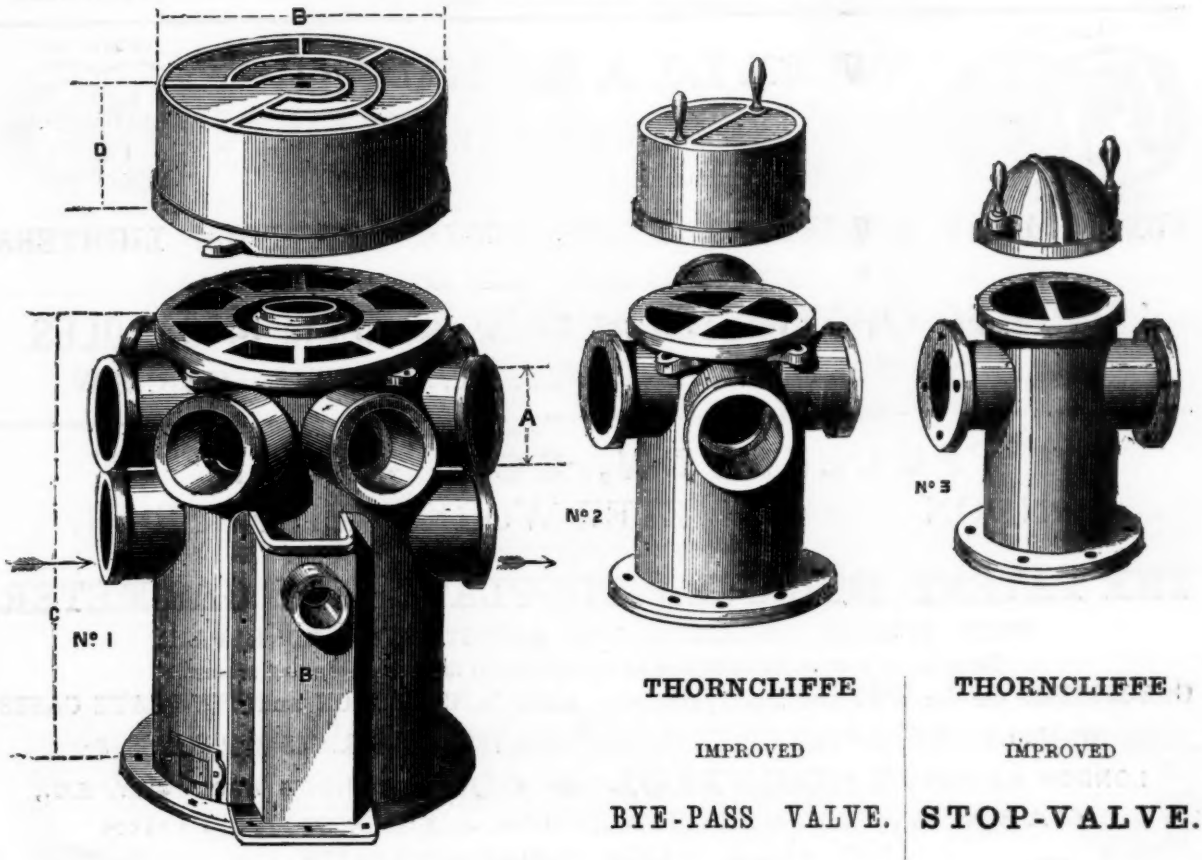
Between Blackfriars' and Southwark Bridges.

THE THORNCLIFFE IMPROVED CENTRE-VALVE,

MANUFACTURED BY

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.



Sizes of the

THORNCLIFFE IMPROVED CENTRE-VALVE.

		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A	Bore of Pipe...	4	5	6	7	8	9	10	12
B	Diam. of Body.	16	20	23	26	28	31	34	40
C	Height of Tank.	33	35	38	43	46	48	51	56
D	Depth of Cover.	8	9	10	11	12	13	14	16
	Total height...	41	44	48	54	58	61	65	72

THORNCLIFFE IMPROVED BYE-PASS VALVE.

SIZES

From 3 ins. upwards.

THORNCLIFFE IMPROVED STOP-VALVE.

SIZES

From 3 ins. upwards.

In all cases the Covers are cast heavy enough to resist any required pressure.

The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

These Valves may be made of any size to suit any position of boxes, to stand any amount of pressure, warranted and tested with gas before leaving the manufactory, prepared to work any number of boxes in rotation—say, two, three, four, five, six, or eight—and for all Valves above 12-inch ports a suitable rack-and-pinion movement is attached if preferred. These Valves (specially arranged) are applicable to inlet or outlet pipes of gasholder, to act as Bye-pass Valves to meters, governors, exhauster, condensers, scrubbers, washers, driers, and duplicate systems of hydraulic main; also to act as Stop-Valves on special mains about the works. Where it is important no impediment be offered to tar or ammoniacal liquor, the same having uninterrupted flow to the general tar-well on the works, and for which purpose the slowly changed, often disordered, and at all times obstructive Slide-Valve (challenging the best of them) is superseded by the exceedingly simple, instantaneously changed Dome-Top Valve, which also carries so marked an index, whether open or shut, at any distance from close observation, providing the Valve can be seen at all. See sketch in perspective, No. 3.

London Office—34, LONDON WALL, MOORGATE STREET, E.C.

JOHN HALL & CO.,

STOURBRIDGE.

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

LOWE'S JET PHOTOMETERS CAN NOW BE RATED TO 14 CANDLES.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

FULLERTON, SON, & CO.,

LONDON ROAD METER-WORKS, EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY GAS-METER,

WITH SPECIAL FACILITIES FOR ADJUSTMENT AND REPAIR,

The principal parts of the mechanism being accessible by the removal of a single Screw.

GAS-METERS on the WET and DRY principles made in CAST-IRON and TIN-PLATE CASES.

STATION-METERS, GOVERNORS, EXPERIMENTAL & TEST METERS, GAS APPARATUS, &c.

LONDON AGENTS: THORNELOE & CO., 34, LONDON WALL CITY, E.C.,

GAS & WATER ENGINEERS, & CONTRACTORS

FOR GAS & WATER WORKS APPARATUS.

SHOW-ROOMS AND WHOLESALE WAREHOUSE FOR

Wrought-Iron Tubes and Fittings for Gas, Water, and Steam; Chandeliers, Pendants, Lamps and Brackets; Plumbers Work, Water-Closets, Pumps, &c.; Lead, Composition, Brass, and Copper Tubes.

METERS SUPPLIED TO ORDER FROM STOCK.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

Analyses by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

Description.	Cubic Feet of Gas per Ton of Coals.	Illuminating Power in Candles.	Coke per Ton of Coal used. Cwt.	Ash in Coke per Cent.	Sulphur in Coa per Cent.
Best Silkstone . .	10,900	17·0	12·8	2·6	1·7
Norfolk Silkstone . .	11,000	15·94	12·5	4·4	1·64
Silkstone Brights . .	11,500	14·5	12·6	7·4	1·85
Silkstone Nuts . .	10,800	15·85	12·66	6·0	0·69

NOTE.—The illuminating power of the Gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

OFFICES, 34. LONDON WALL, CITY, E.C.

TANGYE BROTHERS & HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.;

And BIRMINGHAM (TANGYE BROS.), CORNWALL WORKS, SOHO.

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS.

Over 1000 of the Patent Retort-Lids and fastenings already supplied to the great works of The Gas Company at Beckton.

Several hundreds in use at the works of the London Gas Company.

FIG. 1.

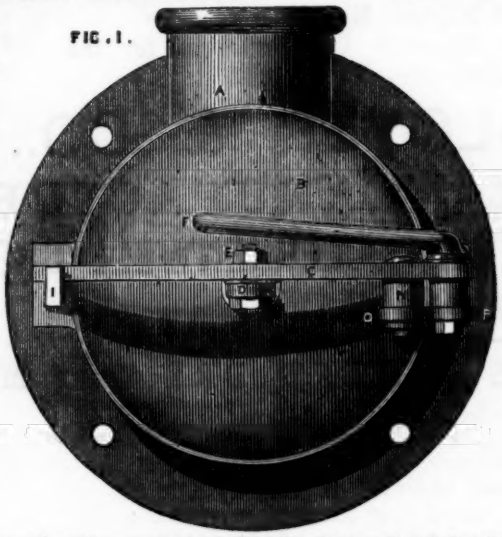
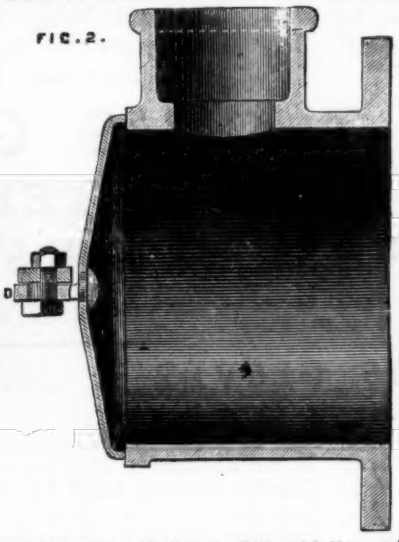


FIG. 2.



Adopted in the Gas-Works at

LIVERPOOL

DUBLIN,

NOTTINGHAM,

ST. ALBANS,

BURSLEM,

BOURNEMOUTH,

WINDSOR,

BOSTON,

&c., &c.

The expensive and cumbersome process of sealing the mouths of Gas-Retorts by means of luting the Lids with lime and other materials hitherto used for that purpose, is henceforth rendered unnecessary, and will be superseded by the very efficient method shown in the accompanying illustrations.

The Self-Sealing Lid reduces labour, saves wear and tear, obviates all the inconvenience and discomfort consequent on the preparation of luting, and effects a great reduction in the working expenses. The cost attending the process of "luting" in several large gas-works exceeds £1000 per annum, ranging in various works from 20s. to 35s. per mouthpiece.

THE "SPECIAL" STEAM-PUMP

IS THE BEST PUMP FOR PUMPING AMMONIACAL LIQUOR, TAR, AND WATER IN GAS-WORKS.

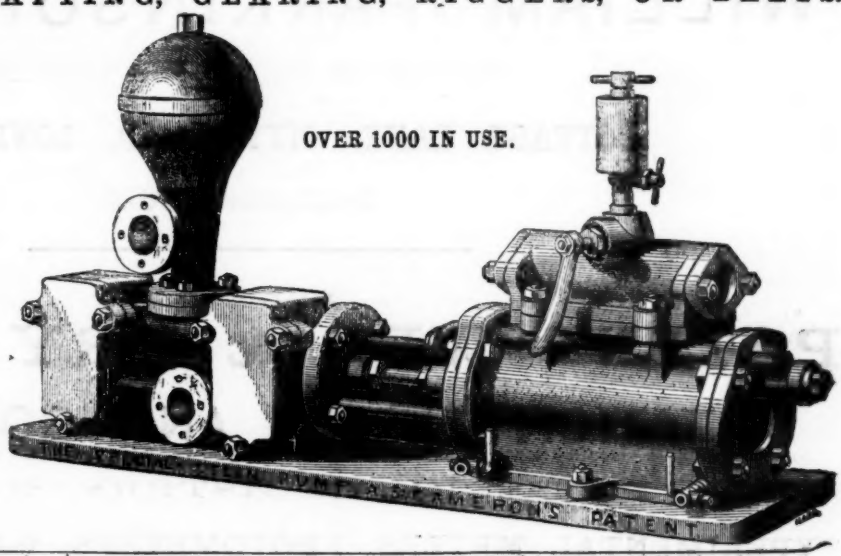
The "SPECIAL" Steam-Pump is adapted for all ordinary purposes for which Steam-driven Pumps are used. It is economical in first cost, occupies very little space, and the wear and tear is reduced to a minimum, because there is absolutely no extraneous gear.

REQUIRES NO SHAFTING, GEARING, RIGGERS, OR BELTS.

Adopted in the following Gas-Works:—

Aylesbury Gaslight and Coke Company.
Alliance and Dublin Gas Company.
Bolton Gas-Works.
Burslem and Tunstall Gas Company.
Brighton Gaslight and Coke Company.
Bury St. Edmund's Gas Company.
Burnley Gas Company.
Bradford Gaslight Company.
Corporation Gas-Works, Stockton.
Chartered Gas Company, Westminster.
Cork Gas-Works.
Dewsbury and Batley Gas Company.
Dublin Consumers Gaslight and Coke Company.
Dunstable Gas-Works.
Imperial Gas-Works, St. Pancras.
Ipswich Gas-Works.
Kingston-upon-Hull Gaslight Company.
London Gaslight Company, Nine Elms.
Lewes Gas-Works.
Louth Gas Company.
Middlesbro' Gas-Works.
Northampton Gas Company.
Phœnix Gas-Works, London.
Richmond Gas Company.
Rio de Janeiro Gas Company.
Reading Gas-Works.
Shipley Gas-Works, near Bradford.
St. Albans Gas-Works.
Sutton, Southcote, and Drypool Gas Company, Hull.
St. Helen's Gas Company, Lancashire.
Windsor Royal Gaslight Company.
Wandsworth and Putney Gas Company.
Woolwich Equitable Gas Company.
Western Gas-Works, Kensal Green.

OVER 1000 IN USE.



Diameter of Steam Cylinder . . . }	In.	2½	3	3	4	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12
Diameter of Water Cylinder . . }	In.	1¼	1	3	2	3	4		4	6	5	6	7	4	6	7	8	6	7	8
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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 18, 1871.

Notes upon Passing Events.

THE Patent Law Committee, under the chairmanship of Mr. Bernhard Samuelson, is collecting a mass of very valuable evidence on the history of important inventions. There are men on the committee who know how to divide the commercial from the legal part of the question. The problem is to develop as much useful ingenuity as possible at as little expense as possible. The laws which regulate contested patents are as bad as can be, but so are all laws framed exclusively by lawyers where the property is valuable. It is only within this generation that it has come to be admitted by the eminent judicial authorities that law is for the benefit of the public, and not of the profession. The theory of the patent law is, that he who invents a useful thing shall have the monopoly of its sale or use for a term of years, in consideration of making public all particulars which will enable it to be manufactured when the patent has expired. Two conditions should be enforced—first, that the thing has not been patented or manufactured for sale before; secondly, that the specification clearly describes what is patented. Add to this what may be difficult to contrive—a rationally competent tribunal for the decision of patent cases—and the problem is solved. The opposite theory is either to grant no patents and no rewards, and leave inventors to their own reward as manufacturers, or to obtain from Parliament a separate vote for each valuable invention. As to the latter idea, it is purely Utopian. It would add a new private business to the House of Commons of the most mischievous description. As to what is erroneously called free trade in inventions, it would perpetuate every kind of machinery on which much money had been spent, however faulty, and it would drive poor inventors to secret inventions—the only inventions that would pay. The following evidence of Mr. Bessemer will carry conviction to the mind of every candid person; the capitalist manufacturer, who hates everything new, cannot be convinced by any argument. Mr. Bessemer has been engaged on his experiments for the improvement of the manufacture of iron more than seventeen years. His first attempts occupied his whole time for two years and a half, and cost between six and seven thousand pounds. So favourable an impression was produced by a paper he read before the British Association, describing the results of his experiments, that within a few weeks he was able to issue licences to ironmasters that brought him thirty thousand pounds; but several ironmasters failed in their attempts "to heat malleable iron rapidly," and the Bessemer process fell in public estimation as quickly as it had risen. Mr. Bessemer was obliged to recommence experiments on a large scale—working from a ton and a half to two tons at once—so that he became practically an ironmaster, and in two years and a half spent about £10,000. He then learned how to make not only malleable iron, but steel of so good a quality that "it could "not be distinguished in the workshops from high-class Sheffield "metal." Not one of the five ironmasters who had taken licences attempted to get over the first difficulties. When Mr. Bessemer had perfected the invention, no maker of iron or steel would take it up. He was obliged to set up a manufactory himself, with two Manchester men as partners. At first their orders were for small quantities of steel, but soon the demand grew, and the old steel manufacturers found that they were being undersold by £20 per ton. Sir John Brown, being about to erect new steel-works, came, saw, and was conquered by the Bessemer process, and took out licences at £2 per ton. Here we see the progress of an invention, or rather series of improvements and inventions, which must have been indefinitely delayed if the author (not an ironmaster or steel manufacturer) had not found security in a patent law which encouraged him to sink a fortune in experiments. The practical result is, railway tires, which once cost £90 per ton, now cost £20. Mr. Bessemer has taken out 26 patents, and, as he states in evidence, without the patent law he, as an engineer, should not have become a manufacturer, or expended the money he gained by his first patents on further improvements. Mr. Bessemer states most truly that a manufacturer may make improvements in detail, but seldom makes any which revolutionize the ordinary system. The manufacturer says to himself, "I have "expended much capital on my machinery—my patterns are valu-"able; all will be turned into old iron and firewood by a new system." The difficulty is to get the first man to try a new invention. In reference to secret inventions, to which class of inventions ingenious minds would direct their attention if there were no patent laws, Mr. Bessemer stated that he, and his father before him, had both been successful secret inventors. He had for 28 years manufactured bronze powder, by which, at first, he realized 1000 per cent., and still 300 per cent.; but because, from the imperfection of the patent laws, it had been kept secret, no improvement had been made in it, although, of the five machines used in making it, three were applicable for other purposes. Mr. Bessemer's father discovered how to recover gold from the "colour water" used by jewellers. He believed that this was by an electro-gilding process, and that if it had been made public, "Elkington's beautiful electro-gilding process would "have been brought before the world 30 years earlier." Mr. Bessemer gives two curious instances of sharp practice in nations which are in the habit of writing very fine things about themselves, and attributing very low shopkeeping principles to England. Prussia has reduced the appropriation of foreign inventions to an art, if not a science. Mr. Bessemer thinks that it is the custom in Prussia for the Patent Office officials to pump the foreign inventor dry, and then refuse his patent. In his own case, he was first informed by the Prussian Patent Office that his invention was not new; then that Mr. Nasmyth was the inventor (this Mr. Nasmyth denied); then that they would give the name of the man in a few weeks. Six weeks passed, and they said, "If we do "not give the name to-morrow we will grant the patent." After a week of to-morrows they produced an English Blue-Book, with his invention published in it, and said, "Your invention is pub-"lished; according to the laws of Prussia we cannot grant you a "patent." Very sharp practice; but the fact is that the Prussians, although very honest in their dealings with each other, like most continentals, have no idea of "fair play" where a foreigner is concerned. By arrangement, Mr. Bessemer supplied Mr. Krupp with all his plans for £5000. Mr. Krupp is one of the largest manufacturers of Bessemer steel, and sells for £130 a ton steel which Mr. Bessemer does not consider superior to his own sold at £15. Baron Schneider, of Creusot, was even sharper than the Prussian Patent Office; but then the baron is Alsatian, and sharp practice is to be expected from him, especially after his conveyance ("the wise "convey it call") of Nasmyth's steam-hammer. Seven years ago Baron Schneider came over to England to treat for a licence to use the Bessemer process, and obtained drawings and information gratis. At the end of two years the baron asked for plans on a great scale. Thirteen large sheet drawings were executed for him gratis. The baron's foreman also came, and was allowed to minutely inspect Mr. Bessemer's works. At length the baron put up the works, but did not use them, for he had agreed to pay a royalty. Finally, the day after the French patent expired, the enor-

mous works on the Bessemer patents were set in motion, and the baron embraced all his foremen on both cheeks with mutual congratulations. The Englishman was done; our Boxers could not have done better. The case of Mr. Nasmyth and Baron Schneider is equally characteristic of the hard treatment which English inventors almost invariably receive in France and Germany, where hot salutations are so plentiful, and fair play an unknown art. France, however, has not arrived at the height of ingenuity of Germany, where a Royal factory forges habitually the trade mark of an English firm, and where inferior articles are regularly made and exported to America and to England with the trade marks of Birmingham and Sheffield manufacturers. The following are the facts of the steam-hammer case:—In November, 1839, Mr. Nasmyth made drawings of the steam-hammer, which he showed to Baron Schneider on a visit that enterprising manufacturer paid to England in 1840. Up to that time Mr. Nasmyth had been prevented from taking out a patent by the expense—£300. In 1842, Mr. Nasmyth visited Creusot. Baron Schneider was absent, and his foreman conducted Mr. Nasmyth over the works. Observing a very fine specimen of forged iron, and asking how it was forged, the manager answered, "We did it with your "steam-hammer, in consequence of the visit Baron Schneider and "I paid to your works, where we saw your designs, and after-"wards made one." Baron Schneider's story is that Mr. Nasmyth stole his patent for the steam-hammer from what he saw when he was at Creusot; but, although the French are a charming people, and very exact in performing contracts when signed and sealed, every one who has had any experience of the commercial classes knows that they have very little regard for truth—their word is not their bond. This national untruthfulness has been widely exhibited in the lying proclamations and bulletins of fictitious successes issued alike by the Imperial, the Revolutionary, and the Communistic authorities, and lately by the official organ of the Versailles Government. No Frenchman blames it; it is a recognized habit. They are not so bad as they paint themselves. To believe party prints, they are all liars, boasters, and traitors. But to return to the patent evidence on another important invention connected with one of our staple manufactures. Mr. Holden, formerly an M.P., has invented, or rather improved, machinery for combing wool. By his combing-machines one woman can do the work of about two hundred handworkers. The work done is of better quality; the reduction of price one-third. The Rev. Mr. Cartwright, whose patents expired in 1798, was the first who attempted wool-combing by machinery. His ideas were of great value, but probably not successful for want of mechanics able to carry them out. Watt had to rely on Boulton for training mechanics before he could make his steam-engines work well. At least two millions sterling has been expended in attempts to perfect wool-combing machines. Mr. Holden, under the protection of the patent laws, has expended over fifty thousand pounds. With such evidence from real inventors—not from the vulture class who batten on the expiring bodies of real inventors, pick out their eyes, and fatten on their entrails—there is no doubt that the report of the committee will be in favour of rewarding inventors with a limited monopoly in return for the publicity they must give to obtain a patent. The patent laws are very bad, costly, dilatory, and uncertain in litigation; but so are the laws of real property a fruitful source of litigation, and even of crime—the finest pasture-fields for Chancery barristers and conveyancers.

The Metropolitan School Board have entered fairly into their work, and laid out plans which must in a very few years give a new character to English education. What is done by the eminent persons who lead the London School Board will mentally give the tone to the whole kingdom. We have never joined the impatient grumblers in complaining that the Board only talked and did nothing. It was necessary to debate much, and learn who was to lead and who follow, before embarking on a voyage in an almost unknown sea. The main difficulties of a plan of elementary education have been settled satisfactorily, none disagreeing on the difficult religious questions except the Romanists, whose only idea of liberty is to make every one do what they like. Some discussion is still going on outside the Board as to what may be called the permissive subjects of education as distinguished from compulsory. One enthusiast proposes swimming and shorthand. With respect to the first, if the place to swim in is provided the rest may be left to competition. A few prizes given by voluntary benevolence will easily develop shorthand in the leisure hours of energetic scholars, shorthand being just one of the arts which can be encouraged and tested by prizes. Some leader-writers, who know nothing practically about the question, are indignant that drawing should be taught and domestic economy passed over. By domestic economy they mean cooking, washing, and ironing. It was a lady member of the Board who sensibly pointed out that practical cookery could not be taught unless at enormous expense, because few would eat the trial meals prepared by children, and few would trust their clothes to infant washerwomen. Washing is so simple an operation that any intelligent girl will learn it in a week's practice; as to cooking, what sort of a kitchen would serve for the school of, say, fifty girls? But although the Board cannot be recommended by any person who knows the questions practically to invest in kitchen-ranges, saucepans, gridirons, and washing-tubs, a great deal might be done by useful books, which would teach first principles. Really sensible school-books, on every subject of useful information, such as William Cobbett would have written if he had not hated any one, are the greatest wants of modern educators. The ordinary run of educational food is more like sawdust in the mouth than wholesome bread. Soyer or Miss Acton could, had they lived, have produced a book which any girl of twelve could have comprehended and enjoyed, describing the various kinds of food in ordinary use and the principles on which boiling, simmering, stewing, broiling, frying, roasting, should be conducted. Nothing in the way of elaborate or expensive preparations should be referred to or attempted, but the importance of degrees of heat, and proportions in weights and measures should be impressed. A girl who understands the first principles of cookery will soon take to the practical part, and, if she can read fluently, learn all worth learning. The same sort of education may be applied to water and soap—the chemistry of clean linen—as regards washing. Let Professor Huxley, Mrs. Garrett-Anderson, and Miss Davies turn their attention to books on domestic economy, the natural history of domestic labour-saving and edible animals. An intelligent demand will create an intelligent supply. Why not the shipwright's book, the carpenter's book, the blacksmith's book, for boys; and, in rural districts, exact and familiar descriptions of the animals and the implements of the farm? We especially need first-class educational reading-books to compete with and supersede the trashy handbooks published by religious societies, often compiled with paste and scissors by their clerks. As to drawing in outline, it goes naturally with writing, and, confined within proper limits, assists boys and girls in all common pursuits by educating the eye.

The claim to find rewards for diligence and talent in the Endowed Charities is so reasonable that it must eventually be conceded. The Corporation of London have been strong enough for the present to perpetuate the race of charity boys of the Uriah Heep class. It will probably be found easier to reform the Corporation, and make it a really representative municipality, than to deprive it of its patronage. The power of School Boards is in its infancy; it will soon be found an element in legislation, although they give no banquets.

All the attempts to amend the abuses of private Bill legislation in regard to public works have hitherto failed to touch the expenses—the greatest scandal of all. So much has been said and written about the cost of railway Acts, that, at length, a plan was devised for enabling communities to obtain tramways at less than five hundred pounds a mile. The assent of the local authority and of the Board of Trade was to be embodied in one general Act; and where a separate Act was applied for, the assent of the local authority and of the Board of Trade was to limit the inquiries of the parliamentary committees. But in this session we have seen Bills which had passed the ordeal of the Board of Trade, received the assent of the House of Commons committee, as well as of the Metropolitan Board and the Corporation of London, thrown out on a third reading. This is not encouraging for those who dream of relieving the over-worked House of Commons of any of its private business. Our relief, as far as the heavy cost of witnesses goes, will probably come from Ireland. The Yorkshireman, the Scotchman, the Cornishman, the Welshman—in fact, every one who lives a day's journey from London feels it a grievance that he cannot get a Bill for water-works, gas-works, a railway, a dock, or a reclamation, without bringing all his local witnesses to be boarded and lodged at a London hotel. The Irish have the good luck to mix up this real wrong with their home rule nonsense. Election inquiries have shown the advantage of sending the judge to the locality and the witnesses, instead of sending the witnesses to the tribunal. Scotland is grumbling on the same solid ground. The question will soon be raised why localities cannot settle their own improvements, by local inquiries, before resorting to a tribunal which is to authorize taxation. In English counties, the proposed Financial Board ought to arrange the preliminary inquiries of much business now left to parliamentary committees; Scotland could arrange her own local affairs, to the great advantage of England; the difficulty with Ireland would be a constant attempt to tax the rest of the kingdom for Irish improvements.

A short Bill for carrying into effect one of the recommendations of the Royal Sanitary Commission has been introduced in the House of Commons by the Government. It is to amalgamate the Poor-Law Board, the Local Government Act Office, and the Sanitary Department of the Privy Council into one Board, to consist of a President, such as the Poor-Law Board now has, and the

following *ex officio* members:—The Lord President of the Privy Council, all the principal Secretaries of State, the Lord Privy Seal, and the Chancellor of the Exchequer, and which is to be called the Local Government Board. At first sight, this looks a much too cumbrous body to work well. It might be thought sufficient to have one responsible working president, like that of the existing Poor-Law Board. With such a body as the above, any one of whom may sign orders, rules, and regulations, the business will be too likely to fall into the hands of the permanent secretaries, who usually work in narrow grooves, and are too apt to be given to "red tape." The intention of the Government, however, is obviously good, and this consolidation of offices must be regarded as a step in the right direction. But it might have gone a little farther, and some of the powers now exercised by the Board of Trade might well have been transferred to the new Board.

Circular to Gas Companies.

The select committee to whom the Municipal Corporations (Borough, &c., Funds) Bill was referred have reported the Bill to the House with what, in parliamentary phrase, are called "amendments," but which in this case make the Bill more dangerous than it was in its original state. A decision of this kind we might have safely predicted from the constitution of the committee, which consisted of 13 borough members, with only two county representatives. With such an enormous preponderance of borough influence, it is not surprising to find that the powers of misapplication of borough funds the Bill will confer are rather increased than diminished by the amendments introduced. First of all, clause 2 is so far altered that it leaves a "governing "body" free to engage in a contest with anybody about anything. The clause now reads as follows:—"When, in the judg-"ment of the governing body of any district, it is expedient for "such governing body to promote, further, or oppose any local "and personal Bill or Bills in Parliament, or to prosecute or defend "any legal proceedings necessary for the promotion or protection "of the interests of the inhabitants of the district, or to carry out "any other proceeding which may be necessary in order to give "effect to their functions or powers under any existing Act of "Parliament, it shall be lawful" to pay the cost out of the public funds under their control.

This it will be seen gives the governing body a very wide discretion, and, under the plea that they are promoting or defending public interests, empowers them to spend public money on all sorts of litigation. The effects of this provision, if it should become law, will no doubt soon be seen in Local Board accounts. If, as lawyers always contend, cheap law would be calculated to increase litigation so much as to make the law a public nuisance, what may be expected to happen when a set of litigious men gain the privilege of enjoying the luxury of lawsuit at other people's expense? We shall probably soon have half the Local Boards in the kingdom indulging their newly-acquired rights at the cost of the unfortunate ratepayers, who will now be completely bound by the proceedings of a majority of the Board. The third clause of the original Bill, which gave a minority of one-third power to appeal to the Home Secretary, has been struck out by the committee, and except in one case the ratepayers are left without any power of effective remonstrance. We notice this case with some satisfaction, because to a certain extent it falls in with a suggestion we made in our last. By a proviso to clause 3 of this amended Bill it will be enacted "that no governing body "of any district containing a population of less than 3000 inha-"bitants shall take any proceedings under the powers of this Act, "involving an expenditure exceeding a sum of £100, without "obtaining the consent of the owners and ratepayers of that "district, to be expressed by resolution in the manner provided "in the Local Government Act (1858) for the adoption of that "Act;" that is, at a public meeting specially convened, and of which due notice had been given. Now what is good for a small district is obviously good for a large one. If the ratepayers in every petty township are to have a direct voice in the control of extraordinary expenditure, it can hardly be denied to the larger boroughs where the necessity for it is even greater. It may be true that it is in small country Boards that little personal animosities are most frequently indulged; but large corporations are seldom free from influences of the same sort, and it is by no means rare to find the will of a majority of a Council or Board in direct opposition to the wishes of a majority of their constituents.

We fear it is but too likely that the Bill will pass the House of Commons. The opponents of the measure have certainly increased in activity since our last, and it is satisfactory to see many local authorities petitioning against the Bill. The opposition must not be allowed to rest. Although a majority of borough members may pass the Bill in the Commons, in deference, as they suppose, to the wishes of their most influential constituents, there is yet another stage to be passed, and overburdened ratepayers may have reason to be thankful that there is still a House of Lords to which they can appeal from the tyrant majority of the Lower House. We cannot too often or too strongly reiterate that this is a ratepayer's question. The money which will be expended under the powers of this Bill, if it should pass, will rarely, if ever, be spent to any useful purpose. It will simply go into the pockets of lawyers and agents; and when (as recently alleged at Whitby) it is impossible to get from a Board £100 for a notorious public improvement, they may recklessly expend several hundreds on fruitless and frivolous parliamentary opposition, and all the ratepayers will gain in return will be the receipt-stamps on the paid bills.

At the moment of going to press we learn that a deputation waited yesterday on Mr. Secretary Bruce, and urged substantially the arguments we have used above against this Bill. Mr. Bruce admitted the great importance of the matter to ratepayers, and promised the matter his serious consideration. Under these circumstances, we have hope that, considering the late period of the session and the state of public business, the Bill will not be forced through the House of Commons this year.

We print in another column the Gas-Works Clauses Act (1847) Amendment Act, which has now received the Royal Assent, and must congratulate our readers on the changes which have been made since Bill No. 1 was introduced to the House of Commons. Another quarter of a century, we should hope, will be allowed to pass before any further attempt is made at general legislation on gas matters. We consider this Act uncalled for and unnecessary, and on one point objectionable; at the same time we feel a reasonable pride in the success of our exertions, which we hope have contributed to make the Act a comparatively harmless measure.

The Lords amendments to the Gas and Water Provisional Orders Confirmation Bill have been agreed to by the Commons, and it now only waits the Royal Assent to become law. In relation to this, there are but two things which require notice. The first is the introduction of a clause incorporating the Gas-Works Clauses Amendment Act with every Provisional Order for gas undertakings confirmed by the Act, so far as the same may not be specially altered by the provisions of the Order; and the second is an amendment to all the Orders which will only require the companies to pay interest on deposits on every 10s. for every six months during which the deposit remains in the hands of the companies.

The accounts of the Metropolitan Gas Companies for 1870 have just been issued, and in our next we shall give a comparative summary.

It is with great regret that we have to mention another serious defalcation on the part of an official of a gas company. We have great hopes that it may not turn out so serious as rumour asserts at present; but, pending the complete investigation of the accounts of the Birmingham Gas Company, which is now being made, we can only give the local report. So far as we can learn, the same system seems to have been pursued in Birmingham that was carried out by Higgs in London to a much greater extent; and it is as clear in the one case as in the other, that under a proper audit of the accounts such a system of plunder would have been impossible.

The report we publish in another place shows that, as we have all along anticipated, the auditor has disallowed the sum paid by the Sheerness Local Board for their new clock and tower, and also the money paid for plans of new gas-works. We may sympathize with the Board so far as the clock and tower are concerned. The members are decidedly behind the times, and they waste many precious hours in useless talk. But there are people on whom advice is thrown away and warning wasted, and we fear such constitute the majority of the Sheerness Local Board. We repeatedly told them what would be the result of their proceedings, and now we feel no pity that they have themselves to bear the expense. The costs of opposing the Sheppy Gas Bill have yet to come before the auditor, to be, no doubt, disallowed, like the foregoing.

We continue to-day our report of the papers read, and the discussions, at the recent meeting of the British Association of Gas Managers. The account of Mr. Eldridge's success in the manufacture of sulphate of ammonia, on a comparatively small scale, is likely to stimulate other managers to follow his example. In his financial statement, however, the author forgot to mention the cost of his plant, and to estimate the depreciation it undergoes. Mr. Wood's explanation of the cause of "Spontaneous Combus-"tion in Coals" is no doubt true, and his hints on storeage deserve attention. Mr. Hartley's very able contribution on "Gas Measure-"ment" treated of a subject of the last importance to gas companies, and the valuable suggestions made merit serious consideration. An account of further experience of "Tar Pavement," by Mr. G. Anderson, brought to a conclusion the scientific business of a meeting second to none in the history of the association for its interest and practical value.

Correspondence.

EXHAUSTING, WASHING, AND CONDENSING GAS.

SIR,—In your JOURNAL of the 6th ult., I observe a letter from Mr. George Anderson on the purification of gas by the direct action of steam; also, in your number of the 20th ult., a letter from Mr. H. W. Smith, in reference to exhausting and purifying gas by the same means. From these it appears that the accumulation of thick tar in the condensers was fatal to the attempts of both your correspondents.

During twelve months experience, at these works, of my direct-action method of exhausting and washing gas by steam, we have had no such effect produced. We have had, however, the contrary effect very strikingly manifested, the steam proving a powerful detergent to the condensers, and thoroughly flushing out any thick tar and salts previously deposited; so that our condensers have given us much less trouble while working with the steam-jet than with exhausting machines.

Probably the discrepancy can be explained by differences in temperature. I prefer to project the steam into the gas after the tar and the primary heat have been extracted, as at the outlet of the primary condenser.

The condensation of gas being a subject to which I happen to have given special attention, I have perused with much interest Mr. Warner's paper, read at the recent meeting of the British Association of Gas Managers, and also the subsequent discussion. Mr. Warner justly insists on thorough control of temperature, as being an important desideratum in condensing apparatus. As a step towards this, permit me to direct the attention of your readers to the arrangement of condensing-pipes described in my paper in your issue of the 23rd of May. In that arrangement, the isothermal lines, or lines of equal temperature, extend horizontally along the line of columns, instead of being limited to the diameter of each column. If such a set of condensers were enclosed in a suitable building, furnished with ventilators at the top and bottom, and capable of being entirely shut from the external air at pleasure, we ought to be able, by controlling the ventilation, to secure sufficient control of the temperature for practical purposes. By such enclosure, also, we should avoid the need of painting or varnishing our condensers, and be allowed to leave them their natural roughness and bareness—a condition much more favourable to the radiation of heat.

If any of your correspondents have tried this plan, perhaps they will oblige your readers by communicating the results.

Linacre Gas-Works, Liverpool,
July 12, 1871. WM. CLELAND.

N.B.—Since writing the above, to make assurance doubly sure, I have opened and examined our steam condensers at six places—near the inlet, outlet, and middle—and find them remarkably clean, the sides of the annulus being as free from adhesive matter as when the castings left the foundry.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JULY 3, 1871.

The NORTHAMPTON IMPROVEMENT Bill was read a third time, with the amendment, passed, and sent to the Commons.

The MUSSELBURGH AND DALKEITH WATER Bill was read a third time, with the amendments; further amendments made, Bill passed, and sent to the Commons.

The CEFN ACREFAIR AND RHOSYMEDRE WATER Bill was returned from the Commons, with the amendments agreed to.

The CHESTERFIELD WATER AND GAS Bill, and the SOUTH LANCASHIRE WATER Bill.—The Commons amendments were considered, and agreed to.

TUESDAY, JULY 4.

The BRIDGWATER WATER Bill was reported, with amendments.

The ABERDEEN MUNICIPALITY EXTENSION Bill was read a third time, with the amendments, passed, and sent to the Commons.

The GAS-WORKS CLAUSES ACT (1847) AMENDMENT (No. 2) Bill, and the RICHMOND SEWAGE Bill, were returned from the Commons, with the amendments agreed to.

THURSDAY, JULY 6.

The GAS AND WATER PROVISIONAL ORDERS CONFIRMATION Bill.—Amendments made in committee, the report thereof to be received on Monday, the 10th inst., and the Bill to be printed as amended.

FRIDAY, JULY 7.

The EDINBURGH AND DISTRICT WATER.—The Select Committee reported that it is not expedient to proceed further with the Bill.

The TODMORDEN GAS Bill was returned from the Commons, agreed to, with amendments.

The SOUTHPORT IMPROVEMENT Bill was returned from the Commons, with the amendments agreed to, with an amendment.

The STAVELEY WATER Bill was returned from the Commons, agreed to.

The DUBLIN MAIN DRAINAGE; MUSSELBURGH AND DALKEITH WATER; THIRSK GAS; and WHITBY GAS Bills, were returned from the Commons, with the amendments agreed to.

The WOLVERHAMPTON IMPROVEMENT Bill was returned from the Commons, with the amendment agreed to.

A petition was deposited against the LIVERPOOL IMPROVEMENT AND WATER Bill, from the Mersey Docks and Harbour Board.

MONDAY, JULY 10.

The LIVERPOOL IMPROVEMENT AND WATER Bill was reported specially from the Select Committee, with amendments.

The SOUTHPORT IMPROVEMENT Bill.—The Commons amendments to Lord's amendments were presented, and agreed to.

GAS AND WATER PROVISIONAL ORDERS Bill.—Amendments reported.

A petition was deposited against any alteration in the NEWRY BOROUGH IMPROVEMENT AND WATER SUPPLY Bill, from the Newry Navigation Company.

TUESDAY, JULY 11.

The ABERDEEN GASLIGHT COMPANY'S Bill.—The Chairman of Committees intimated that the promoters did not intend proceeding further with the Bill.

The BURNLEY BOROUGH IMPROVEMENT Bill was read a third time, with the amendments; further amendments made, Bill passed, and sent to the Commons.

The TODMORDEN GAS Bill.—The Commons amendments considered, some of which were agreed to, and others disagreed to. A consultation between the Lords and Commons Committees to take place.

The ABERDEEN MUNICIPALITY EXTENSION Bill, and the WATERFORD WATER Bill, were returned from the Commons, with the amendments agreed to.

The DORKING GAS Bill was returned from the Commons agreed to, with amendments; the said amendments considered, and agreed to.

The GAS AND WATER PROVISIONAL ORDERS CONFIRMATION Bill was read a third time, with the amendments, passed, and sent to the Commons.

A petition was deposited against any alteration in the NEWRY BOROUGH IMPROVEMENT AND WATER Bill, from R. Gordon.

THURSDAY, JULY 13.

The following Bills received the Royal Assent:—The GAS-WORKS CLAUSES ACT (1847) AMENDMENT (No. 2), INCE WATER, FORFAR GAS, KIDSGROVE GAS, DUNDEE WATER, SALFORD BOROUGH DRAINAGE AND IMPROVEMENT, CEFN ACREFAIR AND RHOSYMEDRE WATER, CHESTERFIELD WATER AND GAS, SOUTH LANCASHIRE WATER, STAVELEY WATER, DUBLIN MAIN DRAINAGE, MUSSELBURGH AND DALKEITH WATER, THIRSK GAS, WHITBY GAS, and DORKING GAS.

The LINCOLN WATER Bill was returned from the Commons, agreed to.

FRIDAY, JULY 14.

The WATERFORD WATER Bill.—The Commons amendments were considered, and agreed to, with amendments.

HOUSE OF COMMONS.

MONDAY, JULY 3, 1871.

The RICHMOND SEWAGE Bill.—The Lords amendments were agreed to.

The DORKING GAS, and the TODMORDEN GAS Bills, as amended, were considered.

The GAS-WORKS CLAUSES ACT (1847) AMENDMENT (No. 2) Bill.—The Lords amendments were agreed to.

TUESDAY, JULY 4.

The STAVELEY WATER Bill was reported, without amendment.

A petition was presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the Ashton Gas Company.

WEDNESDAY, JULY 5.

The THIRSK GAS and the WHITBY GAS Bills.—The Lords amendments were agreed to.

A petition was presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the South Shields Gas Company.

THURSDAY, JULY 6.

The DUBLIN MAIN DRAINAGE Bill.—The Lords amendments were agreed to.

The TODMORDEN GAS Bill was read a third time, and passed, with amendments.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the following water companies:—Wakefield, Cheltenham, Derby, and Shrewsbury; and from the following gas companies:—Southampton, Huyton and Roby, Worcester, Stretford, Tottenham and Edmonton, British, Coventry, Hampton Court, Bristol, Derby, Bolton, Elland-cum-Grietland, Epsom and Ewell, Lichfield, Fareham, Hartlepool, Ormskirk, Plymouth and Stonehouse, Portsea Island, Stourbridge, Stratford-on-Avon, York United, Preston, Wolverhampton, Leamington Priors, Radcliffe and Pilkington, and St. Helen's.

The MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill was referred to a Select Committee, consisting of Mr. Ayrton, Viscount Sandon, Mr. Birley, Mr. Arthur Guest, Mr. Hinde Palmer, Mr. Mundella, Mr. Cawley, Mr. Candlish, Mr. Alderman Lawrence, Mr. Frederick Stanley, Mr. Alderman Carter, Mr. Sheriff, Sir Massey Lopez, Mr. Charles Turner, Mr. Dodds, Mr. Holt, and Mr. Leeman. Five to be the quorum.

FRIDAY, JULY 7.

The MUSSELBURGH AND DALKEITH WATER Bill, and the NORTHAMPTON IMPROVEMENT Bill.—The Lords amendments were agreed to.

The STAVELEY WATER Bill was read a third time, and passed.

The LINCOLN WATER Bill was reported, without amendment.

MONDAY, JULY 10.

The DORKING GAS, and WATERFORD WATER Bills, were read a third time, and passed, with amendments.

The HUDDERSFIELD IMPROVEMENT Bill, as amended, was considered, and an amendment made.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the following gas companies:—Selby, Weston-super-Mare, Mirfield, Hereford, Charlton Consumers, Ossett, Kidderminster, Shipley, Tunbridge Wells, Lea Bridge District, Padiham, Kingston-upon-Thames, Deal and Walmer, Swansea, and Altrincham; and from the following water companies:—Padiham, Northampton, Reigate, Accrington, and Weymouth.

TUESDAY, JULY 11.

The LINCOLN WATER Bill was read a third time, and passed.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the Brighton, Hove, and Preston Constant Service Water Company; and from the following gas companies:—Stafford, Harrogate (two), and Ipswich.

WEDNESDAY, JULY 12.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from Barnstaple; and from the following gas companies:—Wimbledon, Hemel Hempstead, Birmingham and Staffordshire, St. Albans, Wrexham, Stratford, Dunstable, Peterborough, Brighton and Hove, Loughborough, and Cefn Acrefair and Rhosymedre; and from the following water companies:—Barnstaple, Wrexham, Hemel Hempstead, and Bury and Radcliffe.

The MUNICIPAL CORPORATION (BOROUGH FUNDS) Bill was reported.

THURSDAY, JULY 13.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the following gas companies:—Windsor Royal, and Dukinfield; and from the following water companies:—Brompton, Chatham, Gillingham, and Rochester.

FRIDAY, JULY 14.

Petitions were presented against the MUNICIPAL CORPORATIONS (BOROUGH FUNDS) Bill, from the following companies:—Folkestone Gas, Folkestone Water, Brentford Gas, and Bury and Radcliffe Water.

THE GAS-WORKS CLAUSES ACT, 1871.

WHEREAS it is expedient that the provisions contained in the Gas-Works Clauses Act, 1847, should be amended:—

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows (that is to say):—

Construction of Act.

1. The Gas-Works Clauses Act, 1847, and this Act, shall be construed together as one Act, and the provisions of this Act shall be held to repeal and supersede such of the provisions of that Act as are inconsistent with this Act.

Short Title.

2. This Act may be cited as "The Gas-Works Clauses Act, 1871."

Application of Act.

3. The provisions of this Act shall apply to every gas undertaking authorized by any special Act hereafter passed, or by any Provisional Order made under the authority of the Gas and Water Works Facilities Act, 1870, save where the said provisions are expressly varied or excepted by any such special Act or Provisional Order, and every such special Act and Provisional Order is in this Act included in the term "the special Act."

Interpretation.

4. Terms used in this Act have the same meanings respectively as the same terms have when used in the Gas-Works Clauses Act, 1847, and in the Gas and Water Works Facilities Act, 1870.

The term "prescribed" in this Act shall mean prescribed by the special Act;

The term "premises" in this Act shall include house and building;

And the expression "superior courts" or "court of competent jurisdiction," in this Act or in any Act wholly or partially incorporated herewith, shall be read and have effect as if the debt or demand in respect of which the expression is used were an ordinary simple contract debt and not a debt or demand created by statute.

General Provisions.

Prohibition against Erecting Gas-Works elsewhere than on Lands Specified in Schedule.

5. The undertakers shall not manufacture gas, or any residual products, except upon lands described in the special Act, and they shall not store gas, except upon those lands, without the previous consent in writing of the owner, lessee, and occupier of every dwelling-house situate within 300 yards of the limits of the site where such gas is intended to be stored.

Sale of Superfluous Lands.

6. The undertakers may sell and dispose of any lands which are vested in them, or which they are authorized to purchase, or which they may hereafter acquire, and which shall not be required for the purposes of the undertaking, and the provisions of the Lands Clauses Consolidation Act, 1845, sections 128 to 132 (both sections inclusive) shall apply to any such sale; and the undertakers may also from time to time sell and dispose of any works, buildings, or erections on any lands belonging to them which shall not be required for the purposes of the undertaking.

Receipts of Guardians, &c., to be sufficient Discharge.

7. If any money be payable to a shareholder in a gas undertaking, being a minor, idiot, or lunatic, the receipt of his or her respective guardian or committee shall be a sufficient discharge to the undertakers for the same.

For Appointment of Receiver.

8. The mortgagees of the undertakers may enforce payment of arrears of interest or principal, or principal and interest, due on their mortgages, by the appointment of a receiver; and in order to authorize the appointment of a receiver in respect of principal, or principal and interest, the amount owing to the mortgagees by whom the application for a receiver is made shall not be less than in the whole £1000, or such sum as shall be specified in the special Act.

Undertakers not Exempted from Indictment.

9. Nothing in this or the special Act shall exonerate the undertakers from any indictment, action, or other proceeding for nuisance in the event of any nuisance being caused by them.

Power to take Easements, &c., by Agreement.

10. Persons empowered by the Lands Clauses Consolidation Act, 1845, to sell and convey or release lands, may, if they think fit, subject to the provisions of that Act and of the Lands Clauses Consolidation Acts Amendment Act, 1860, grant to the undertakers any easement, right, or privilege, not being an easement of water, required for the purposes of this Act in, over, or affecting any such lands; and the provisions of the last-mentioned Acts with respect to lands and rent-charges, as far as the same are applicable in this behalf, shall extend and apply to such grants, or to such easement, rights, or privileges as aforesaid.

Supply of Gas to Owners and Occupiers of Premises.

Undertakers to furnish sufficient Supply of Gas to Owners and Occupiers within the Limits of the Special Act.

11. The undertakers shall, upon being required so to do by the owner or occupier of any premises situate within 25 yards from any main of the undertakers, or such other distance as may be prescribed, give and continue to give a supply of gas for such premises, under such pressure in the main as may be prescribed, and they shall furnish and lay any pipe that may be necessary for such purpose, subject to the conditions following (that is to say):—

The cost of so much of any pipe for the supply of gas to any owner or occupier as may be laid upon the property of such owner or in the possession of such occupier, and of so much of any such pipe as may be laid for a greater distance than thirty feet from any pipe of the undertakers, although not on such property, shall be defrayed by such owner or occupier.

Every owner or occupier of premises requiring a supply of gas shall—

Serve a notice upon the undertakers at their office, specifying the premises in respect of which such supply is required, and the day (not being an earlier day than a reasonable time after the date of the service of such notice) upon which such supply is required to commence;

Enter into a written contract with the undertakers (if required by them so to do) to continue to receive and pay for a supply of gas for a period of at least two years, of such an amount that the rent payable for the same shall not be less than twenty pounds per centum per annum on the outlay incurred by the undertakers in providing any pipe to be provided by them for the purpose of such supply; and

Give to the undertakers (if required by them so to do) security for the payment to them of all moneys which may become due to them by such owner or occupier in respect of any pipe to be furnished by the undertakers and in respect of gas to be supplied by them.

Provided always, that the undertakers may, after they have given a supply of gas for any premises, by notice in writing, require the owner or occupier of such premises, within seven days after the date of the service of such notice, to give to them security for the payment of all moneys which may from time to time become due to them in respect of such supply, in case such owner or occupier has not already given such security, or in case any security given has become invalid, or is insufficient, and in case any such owner or occupier fails to comply with the terms of such notice, the undertakers may, if they please, discontinue to supply gas for such premises, so long as such failure continues.

Quality of Gas.

12. The quality of the gas supplied by the undertakers shall, with respect to its illuminating power, be such as to produce at the testing-place, provided in conformity with this Act, a light equal in intensity to that produced by the prescribed number of sperm candles of six in the pound, and such gas shall as to its purity not exhibit any trace of sulphuretted hydrogen when tested in accordance with the rules prescribed in that behalf in Part II. of the Schedule A to this Act annexed.

Undertakers may require Consumers to use Meters.

13. Every consumer of gas supplied by the undertakers shall, if required to do so by them, consume such gas by a meter duly stamped under the authority of an Act passed in the session of Parliament held in the twenty-second and twenty-third years of the reign of Her present Majesty, intituled "An Act for Regulating Measures used in Sales of Gas," and being a legal meter within the meaning of the said Act, or by a meter supplied or approved by the undertakers: Provided always, that where the provisions of the said Act are in force, no meter shall be used, unless the same shall be a legal meter within the meaning of the said Act, and that elsewhere the undertakers shall not refuse to approve of any meter which when duly tested according to the rules contained in the said Act for regulating measures used in sales of gas is found to be correct within the meaning of the said Act.

Undertakers to supply Meters.

14. The undertakers shall supply to any owner or occupier of premises within the limits of the special Act requiring the same a meter for registering gas supplied by them: Provided always, that such owner or occupier shall, if required, previous to receiving such meter, give to the undertakers security for payment to them of the price of such meter if he desires to purchase the same, or of the rent of such meter if he desires to hire the same.

Meters not to be Connected or Disconnected without Notice.

15. No consumer shall connect any meter with any pipe through which gas is supplied by the undertakers to such meter, or disconnect any meter from any such pipe, unless he shall have given to the undertakers not less than 24 hours notice in writing of his intention so to do, and if any person acts in contravention of this section he shall be liable for each offence to a penalty not exceeding 40s.

Nature and Amount of Security.

16. Where any owner or occupier is required by this Act to give security to the undertakers, such security may be by way of deposit or otherwise, and of such amount as he and the undertakers agree on, or as, in default of agreement, may be determined, on the application of either party, by two justices, who may also order by which of the parties the costs of the proceedings before them shall be paid, and the decision of the justices shall be final and binding on all parties.

Consumer to keep his Meter in proper Order.

17. Every consumer of gas supplied by the undertakers shall at all times, at his own expense, keep all meters belonging to him, whereby any gas of the undertakers is registered, in proper order for correctly registering such gas, and in default of his so doing the undertakers may cease to supply gas through such meter. The undertakers shall have access to and be at liberty to take off, remove, test, inspect, and replace any such meter at all reasonable times, such taking off, removal, testing, inspecting, and replacing to be done at the expense of the undertakers if the meter be found in proper order, but otherwise at the expense of the consumer.

Power to the Undertakers to let Meters.

18. The undertakers may let for hire any meter for ascertaining the quantity of gas consumed or supplied, and any fittings thereto, for such remuneration in money, and on such terms with respect to the repair of such meter and fittings, and for securing the safety and return to the undertakers of such meter, as may be agreed upon between the hirer and the undertakers, and such remuneration shall be recoverable in the same manner as the rents or sums due to the undertakers for gas, and such meters and fittings shall not be subject to distress, or to the landlord's remedy for rent of the premises where the same may be used, nor to be taken in execution under any process of a court of law or equity, or any proceedings in bankruptcy against the persons in whose possession the same may be.

Undertakers to keep Meter let for Hire in Repair.

19. The undertakers shall at all times, at their own expense, keep all meters let for hire by them to any consumer, in proper order for correctly registering gas; and in default of their so doing the consumer shall not be liable to pay rent for the same during such time as such default continues. The undertakers shall, for the purposes aforesaid, have access to and be at liberty to remove, test, inspect, and replace any such meter at all reasonable times.

Register of Gas-Meters to be primâ facie Evidence.

20. The register of the meter shall be *primâ facie* evidence of the quantity of gas consumed, and in respect of which any rent is charged and sought to be recovered by the undertakers: Provided always, that if the undertakers and the consumer differ as to the quantity consumed, such difference may be determined upon the application of either party by two justices, who may also order by which of the parties the costs of the proceedings before them shall be paid, and the decision of the justices shall be final and binding on all parties.

Power to enter Buildings for ascertaining Quantities of Gas consumed.

21. Any officer appointed by the undertakers may at all reasonable times enter any building or land lighted with gas supplied by the undertakers, in order to inspect the meters, fittings, and works for the supply of gas, and for the purpose of ascertaining the quantity of gas consumed or supplied; and if any person hinder such officer as aforesaid, from entering and making such inspections as aforesaid at any reasonable time, he shall for every such offence forfeit to the undertakers a sum not exceeding five pounds.

Power to remove Meter and Fittings.

22. In all cases in which a consumer of gas supplied by the undertakers ceases to require a supply of such gas, and in all cases in which the undertakers are authorized to take away and cut off the supply of gas from any premises, it shall be lawful for the undertakers, their agents or workmen, after twenty-four hours notice in writing, under the hand of the secretary, or other properly authorized officer of the undertakers, to the occupier, or if unoccupied, then to the owner or lessee, or to the agent of the owner or lessee of any premises in which any pipes, meters, fittings, or apparatus belonging to the undertakers are laid or fixed, and through or in which the supply of gas is from any such cause discontinued, to enter such premises between the hours of nine in the morning and four in the evening, for the purpose of removing and to remove such pipes, meters, fittings, or apparatus, repairing all damage caused by such entry or removal.

Recovery of Charges for Gas.

23. In case any person who shall have been supplied with gas by the undertakers shall neglect or refuse to pay the amount due in respect of such supply, any justice may issue his summons to such person, requiring him to appear at a time and place named therein, and then and there to show cause why the sum so demanded should not be paid; and if on the appearance of such person, or in default of appearance after proof of the service of the summons, either personally or at the last known place of abode or of business of such person, no sufficient cause can be shown to the contrary, any justice may issue his warrant of distress for the seizure and sale of the goods and chattels of such persons, for the recovery of the amount which may be proved before such justice to be due from such person, together with such costs, including the cost of cutting off the gas, if the same shall have been cut off by the undertakers, as to such justice shall seem just and reasonable.

Supply of Gas to Local Authorities.

Supply and Price of Gas to Public Lamps.

24. The undertakers shall supply gas to any public lamps within the distance of fifty yards from any of the mains of the undertakers, in such quantities as the local authority of each district or the trustees of any turnpike road or any Highway Board within the limits of the special Act may from time to time require to be supplied, and the price to be charged by the undertakers, and to be paid to them for all gas so supplied, shall be settled by agreement between the

local authorities and the undertakers, and in case of difference by arbitration, regard being had to the circumstances of the case and the prices charged to private consumers in the district.

As to Consumption of Gas supplied to the Public Lamps.

25. The gas supplied to the public lamps within the limits of the special Act shall be consumed by meter at the option either of the local authority of the district or the undertakers, and in case of its being consumed by meter the meter shall be provided and fixed by the undertakers, and be paid for by the party requiring it.

If the gas is supplied to the public lamps in any district by average meter indication, the undertakers shall, for securing uniformity of consumption between metered and unmetered lamps, from time to time provide the public lamps in such district with proper self-acting pressure regulators and burners to the satisfaction of the local authority of such district; and the average amount of the indications of all the meters attached to the public lamps within such district under the control of the local authority shall, except as hereinafter mentioned, be deemed to be the amount consumed by each such lamp in such district.

Governors for Street-Lamps.

26. In case gas is supplied to the public lamps in any district by the undertakers, they or the local authority of such district may, at their own expense, cause to be affixed to each lamp the instrument known as a street-lamp governor, and the undertakers or such local authority (as the case requires) shall be entitled to have access thereto for the purpose of examining the same.

For Settlement of Differences between the Undertakers and the Local Authority.

27. Any difference which may arise between the undertakers and any local authority in relation to the supply or consumption of gas to or by such local authority, shall be from time to time settled by arbitration in manner provided by the Companies Clauses Consolidation Act, 1845, with respect to the settlement of disputes by arbitration.

TESTING OF GAS.

Testing-Place.

28. The undertakers shall, under the authority of the special Act, cause to be provided, at the place prescribed, and within the prescribed time, a testing-place, with apparatus therein, for the purposes following, or such of them as may be prescribed by the special Act (that is to say):—

1. For testing the illuminating power of the gas supplied;
2. For testing the presence of sulphuretted hydrogen in the gas supplied.

The said apparatus shall be in accordance with the regulations prescribed in Part I. of the Schedule A to this Act annexed, or according to such rules as may from time to time be substituted in lieu thereof by any special Act, and shall be so situated and arranged as to be used for the purpose of testing the illuminating power and purity of the gas supplied by the undertakers, and the undertakers shall at all times thereafter keep and maintain such testing-place and apparatus in good repair and working order.

Appointment and Powers of Gas Examiners.

29. The local authority of any district within the limits of the special Act, where the gas is not supplied by such local authority, may after the passing of the special Act from time to time appoint, or may appoint and keep appointed, a competent and impartial person to be a gas examiner to test the gas at the testing-place provided in conformity with the provisions of this Act; and such gas examiner may there test the illuminating power and purity of the gas supplied by the undertakers, on any or every day between the hours of five o'clock and ten o'clock in the afternoon from the first day of October to the thirty-first day of March, both inclusive, and on any or every day between the hours of eight o'clock and eleven o'clock in the afternoon from the first day of April to the thirtieth day of September, both inclusive.

Two Justices may appoint Gas Examiner.

30. Where no such gas examiner is appointed, or where the testing of the gas is imperfectly attended to by the local authority, two justices, on the application of consumers of the gas of the undertakers not being less than five, by order in writing may appoint some competent and impartial person to be gas examiner, and such person may at any time within the hours aforesaid, on producing the said order, enter on the premises of the undertakers, and there test the illuminating power and purity of the gas supplied by them.

Representation of Undertakers.

31. The undertakers may, if they think fit, on each occasion of the testing of the gas by the gas examiner, be represented by some officer, but such officer shall not interfere in the testing.

Mode of Testing.

32. Any tests taken in pursuance of this Act shall be taken in accordance with the rules prescribed in Part II. of the Schedule A to this Act annexed.

Report of Gas Examiner.

33. The gas examiner shall, on the day immediately following that on which the testing of the illuminating power or purity of the gas has been conducted, make and deliver a report of the results of his testing to the local authority or justices by whom he was appointed, and to the undertakers, and such report shall be receivable in evidence.

Access to Testing-Place.

34. The undertakers shall give to the gas examiner and to his assistants, and to every local authority within the limits of the special Act, and their agents, access to the testing-place, and shall afford all facilities for the proper execution of this Act; and in case the undertakers make default in complying with any of the provisions of this section, they shall for every such default be liable to a penalty not exceeding five pounds, to the local authority, or to the persons making the application.

ACCOUNTS, *&c.*

35. The undertakers shall fill up and forward to the local authority of every district within the limits of the special Act, on or before the twenty-fifth day of March in each year, an annual statement of accounts, made up to the thirty-first day of December then next preceding, as near as may be in the form and containing the particulars specified in the Schedule B to this Act annexed.

The undertakers shall keep copies of such annual statement at their office, and sell the same to any applicant at a price not exceeding one shilling for such copy.

The Board of Trade, with the consent of the undertakers, may alter the said forms for the purpose of adapting them to the circumstances of the undertaking, or of better carrying into effect the objects of this section.

In case the undertakers make default in complying with the provisions of this section, they shall be liable to a penalty not exceeding forty shillings for each day during which such default continues.

PENALTIES.

Penalty for Failure to supply Gas.

36. Whenever the undertakers neglect or refuse to give a supply of gas to any owner or occupier of premises within the limits of the special Act entitled to the same, under such pressure as is prescribed, they shall be liable to a penalty not exceeding forty shillings for each day during which such default continues.

Whenever the undertakers neglect or refuse to supply gas as by this Act required to all or any of the public lamps in accordance with the provisions of this Act, they shall be liable to a penalty not exceeding forty shillings for each default.

If it shall be proved to the satisfaction of any two justices, not being shareholders in the undertaking, after hearing the parties, that on any day the gas supplied by the undertakers is under less pressure, of less illuminating power, or of less purity than it ought to be according to the provisions of this or the special Act, the undertakers shall in every such case forfeit and pay to the local authority or other persons making application for testing the gas such sum not exceeding £20 as the justices shall determine.

Penalties not Cumulative.

Penalties imposed on the undertakers for one and the same offence by several Acts of Parliament shall not be cumulative, and for such purpose the special Act and the Acts incorporated therewith shall be deemed several Acts.

Cost of Experiment to be Paid according to Event.

37. Where the gas examiner is appointed by the justices as aforesaid, the costs of and attending such experiment, including the remuneration to be paid to the person making the same, and the costs of the proceedings before the justices, shall be ascertained by such justices, and in the event of any penalty being imposed on the undertakers shall be paid, together with such penalty, by the undertakers, but in the event of no penalty being imposed the costs shall be in the discretion of the justices.

Penalty for Injuring Meters.

38. Every person who wilfully, fraudulently, or by culpable negligence injures or suffers to be injured any pipes, meter, or fittings belonging to the undertakers, or alters the index to any meter, or prevents any meter from duly registering the quantity of gas supplied, or fraudulently abstracts, consumes, or uses gas of the undertakers, shall (without prejudice to any other right or remedy for the protection of the undertakers or the punishment of the offender) for every such offence forfeit and pay to the undertakers a sum not exceeding five pounds, and the undertakers may in addition thereto recover the amount of any damage by them sustained; and in any case in which any person has wilfully or fraudulently injured or suffered to be injured any pipes, meter, or fittings belonging to the undertakers, or altered the index to any meter, or prevented any meter from duly registering the quantity of gas supplied, the undertakers may also, until the matter complained of has been remedied, but no longer, discontinue the supply of gas to the person so offending (notwithstanding any contract previously existing); and the existence of artificial means for causing such alteration or prevention, or for abstracting, consuming, or using gas of undertakers, when such meter is under the custody or control of the consumer, shall be *primâ facie* evidence that such alteration, prevention, abstraction, or consumption, as the case may be, has been fraudulently, knowingly, and wilfully caused by the consumer using such meter.

RECOVERY OF GAS-RENTS.

Incoming Tenants not liable to pay Arrears of Gas-Rents, &c.

39. In case any consumer of gas supplied by the undertakers leave the premises where such gas has been supplied to him without paying the gas-rent or meter-rent due from him, the undertakers shall not be entitled to require from the next tenant of such premises the payment of the arrears left unpaid by the former tenant, unless such incoming tenant has undertaken with the former tenant to pay or exonerate him from the payment of such arrears.

Recovery of Rents, &c.

40. If any person supplied with gas, or with any gas-meter or fittings, by the undertakers, neglects to pay to the undertakers the rent due for such gas, or the rent or money due to the undertakers for the hire or fixing of such meter, or any expenses lawfully incurred by the undertakers in cutting off the gas from the premises of such person, the undertakers may recover the sum so due in like manner as a penalty under this Act.

Recovery of Sums due to Undertakers.

41. Whenever any person neglects to pay any rent or sum due and payable by him to the undertakers, the undertakers may recover the same, with full costs of suit, in any court of competent jurisdiction, and the remedy of the undertakers under this enactment shall be in addition to their other remedies for the recovery of such rent or sum.

LEGAL PROCEEDINGS.

Contents of Summons or Warrant.

42. Any summons or warrant issued for any of the purposes of this Act may contain, in the body thereof or in a schedule thereto, several names and several sums.

Warrant of Distress shall include Costs.

43. Any justice who issues a warrant of distress in pursuance of the provisions of this Act may order that the costs of the proceedings for the recovery of the money to be levied shall be paid by the person liable to pay such money, and such costs shall be ascertained by the justice, and shall be included in the warrant of distress for the recovery of such money.

Summary Proceedings for Offences, Penalties, &c.

44. All offences and penalties under this Act, and all money forfeited, and all money and costs by this Act directed to be recovered as penalties, may be prosecuted and recovered in manner directed by the Gas-Works Clauses Act, 1847, with respect to the recovery of penalties.

Service of Notices by Undertakers.

45. Every notice which the undertakers are by this Act required to serve upon any person shall be served by being delivered to the person for whom it is intended, or by being left at his usual or last known place of abode, or sent by post addressed to such persons, or if such person or his address be not known to the undertakers, and cannot after due inquiry be found or ascertained, then by being affixed for three days to some conspicuous part of the premises to which such notice relates.

Liability to Gas-Rent not to disqualify Justices from Acting.

46. No justice or judge of any county court or quarter sessions shall be disqualified from acting in the execution of this Act by reason of his being liable to the payment of any gas-rent or other charge under this Act.

SCHEDULE A.

PART I.

Regulations in respect of Testing Apparatus.

1. *The apparatus for testing the illuminating power of the gas* shall consist of the improved form of Bunsen's photometer, known as Letheby's open 60-inch photometer, or Evans's enclosed 100-inch photometer, together with a proper meter, minute-clock, governor, pressure-gauge, and balance.

The burner to be used for testing the gas shall be such as shall be prescribed.

The candles used for testing the gas shall be sperm candles of six to the pound, and two candles shall be used together.

2. *The apparatus*—

(*a.*) *For Testing the Presence in the Gas of Sulphuretted Hydrogen.*—A glass vessel containing a strip of bibulous paper moistened with a solution of acetate of lead, containing sixty grains of crystallized acetate of lead dissolved in one fluid ounce of water.

PART II.

Rules as to Mode of Testing Gas.

1. *Mode of Testing for Illuminating Power.*

The gas in the photometer is to be lighted at least fifteen minutes before the testings begin, and it is to be kept continuously burning from the beginning to the end of the tests.

Each testing shall include 10 observations of the photometer, made at intervals of half a minute.

The consumption of the gas is to be carefully adjusted to five cubic feet per hour.

The candles are to be lighted at least ten minutes before beginning each testing, so as to arrive at their normal rate of burning, which is shown when the wick is slightly bent and the tip glowing. The standard rate of consumption for the candles shall be 120 grains each per hour. Before and after making each set of 10 observations of the photometer, the gas examiner shall weigh the candles, and if the combustion shall have been more or less per candle than 120 grains per hour he shall make and record the calculations requisite to neutralize the effects of this difference.

The average of each set of 10 observations is to be taken as representing the illuminating power of that testing.

2. *Mode of Testing.*

(*a.*) *For Sulphuretted Hydrogen.*—The gas shall be passed through the glass vessel containing the strip of bibulous paper moistened with the solution of acetate of lead for a period of three minutes, or such longer period as may be prescribed; and if any discoloration of the test-paper is found to have taken place, this is to be held conclusive as to the presence of sulphuretted hydrogen in the gas.

SCHEDULE B.—FORM OF ANNUAL ACCOUNTS.

The _____ Gas Company, Year ended December 31, 18 .

A.—*Statement of Share Capital, on December* 31, 18 .

1. Description of Capital.	2. Maximum Dividend authorized.	3. No. of Shares issued.	4. Nominal Amount of Share.	5. Called up per Share.	6. Total paid up.	7. Amount issued but not paid up.	8. Remaining to be issued.	9. Total Amounts authorized.

B.—*Statement of Loan Capital, on December* 31, 18 .

1. Description of Loan (Mortgage, Bond, Debenture, Stock, &c.).	2. Rate per Cent. of Interest.	3. Total Amounts borrowed at Dec. 31, 18 .	4. Remaining to be borrowed.	5. Total Amounts authorized.

Total share capital paid up (see A), £ ; ditto loan ditto borrowed (see B), £ : total capital received, £ .

C.—*Capital Account, for the Year ended December* 31, 18 .

	Expenditure, to Dec. 31, 18 .	Expended this Year.	Total to Dec. 31, 18 .		Certified Receipts, to Dec. 31, 18 .	Received during Year.	Total Receipts to Dec. 31, 18 .
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
1.—To expenditure to Dec. 31, 18 .				1.—By ordinary shares, of £ each			
Since that date—				2.—By ditto, of £ each . . .			
2.—To lands acquired, including law charges				3.—By preference shares, of £ each			
3.—To new buildings, manufacturing plant, machines, storeage wks., and other structures connected with manufacture.				4.—By debenture stock.			
4.—To new mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution				5.—By mortgages and bonds . . .			
5.—To new meters (not in place of old ones), including fixing . . .				6.—By amount received in anticipation of calls			
6.—To costs of promoting special Act.							
7.—To special items (if any) . . .							
Total expenditure				Total			
To balance of capital account							
			£				£

D.—*Revenue Account, for the Year ended December* 31, 18 .

To Manufacture of gas—	£ s. d.	£ s. d.	By Sale of gas—	£ s. d.	£ s. d.
1.—Coals, including dues, carriage, unloading, and all expenses of depositing same on works			1.—Common gas (cubic feet), at s. d. per 1000 cubic feet . . .		
2.—Purifying materials, oil, water, and sundries at works . . .			2.—Cannel gas (cubic feet), at s. d. per 1000 cubic feet . . .		
3.—Salaries of engineers, including chief engineer (if any), superintendents, and officers at works.			3.—Public lighting and under contracts . .		
4.—Wages and gratuities at works . . .			4.—Rental of meters		
5.—Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour			Residual products—		
Less old material sold			5.—Coke, less labour and cartage		
			6.—Breeze, ditto.		
Distribution of gas—			7.—Tar, ditto.		
6.—Salaries of surveyor, chief inspector, inspectors, assistant inspectors, and clerks in Light Office			8.—Ammoniacal liquor, ditto.		
7.—Repair, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour					
8.—Repairing, renewing, and refixing meters.			9.—Rents		
Public lamps—			10.—Transfer fees		
9.—Lighting and repairing			Other item (if any)		
Rents, rates, and taxes—					
10.—Rents					
11.—Rates and taxes.					
Management—					
12.—Directors allowances					
13.—Salaries of secretary, accountant, and clerks, office-keepers, and messengers .					
14.—Collectors commission or salaries . . .					
15.—Stationery and printing					
16.—General establishment charges and incidentals.					
17.—Auditor					
Law and parliamentary charges—					
18.—Law					
19.—Parliamentary (oppositions)					
20.—Depreciation-fund for works on leasehold lands (if any).					
21.—Bad debts					
Other items (if any)					
Total expenditure			Total receipts		£
Balance carried to profit and loss account (E) .					
		£			

E.—*Profit and Loss Account (Net Revenue), for the Year ended December* 31, 18 .

Dr.	£ s. d.		£ s. d.
1.—To amount (if any) carried to reserved fund account (F) from profits of 18		1.—By balance of net profit brought from last account (Dec. 31, 18)	
2.—To interest on temporary loans, and moneys received in anticipation of calls		2.—By amount drawn from reserved fund (if any) Less dividend paid for the half year ended Dec. 31, 18	
3.—To ditto on mortgages and bonds, accrued to Dec. 31, 18		3.—Balance brought from revenue account (D), being profit for year to December, 18	
4.—To ditto on debenture stock, to ditto		4.—Interest on moneys deposited	
5.—To half year's dividend on first preferential, to June 30, 18			
6.—To ditto second preferential, to ditto			
7.—To ditto on ordinary shares, at per cent.			
To balance of net profit to be carried to next account, subject to half year's dividends, to Dec. 31, 18			
	£		£

F.—*Reserved Fund Account, for the Year ended December* 31, 18 .

Dr.	£ s. d.		£ s. d.
1.—To amount (if any) carried to profit and loss account (E), to make up deficiencies of dividends, to Dec. 31, 18		1.—By balance brought from last account	
2.—To ditto paid for extraordinary claim or demand (if any)		2.—By ditto brought from profit and loss account (E)	
3.—To ditto of balance to be carried to next account		3.—By interest on amount invested	

Like accounts must be given for depreciation-fund for works on leaseholds (if any).

G.—*Statement of Coals, during the Year ended December* 31, 18 .

Description of Coals.	In Store, December 31, 18 .	Received during Year.	Carbonized or Used during Year.	In Store, December 31, 18 .
	Tons.	Tons.	Tons.	Tons.
Common				
Cannel				

H.—*Statement of Residual Products, for the Year ended December* 31, 18 .

Description of Residual.	In Store, December 31, 18 . Estimated.	Made during Year. Estimated.	Used in Manufacture during Year. Estimated.	Sold during Year.	In Store, December 31, 18 . Estimated.
Coke—					
Common, chaldrons of 36 bushels					
Cannel, ditto					
Breeze—ditto					
Tar—gallons					
Ammoniacal liquor—butts of 108 gallons					

I.—*General Balance-Sheet, on December* 31, 18 .

Dr.	£ s. d.		£ s. d.
1.—To capital account— Balance at credit thereof (Account C)		1.—By cash at bankers	
2.—To profit and loss account— Balance at credit thereof (Account E)		2.—By ditto on deposit or at interest	
3.—To reserved fund— Balance at credit thereof (Account F)		3.—By coals for stock on hand, Dec. 31, 18	
4.—To depreciation-fund (for works on leasehold lands)— Balance at credit thereof (Account)		4.—By coke and breeze, ditto	
5.—To unpaid dividends		5.—By tar and other products, ditto	
6.—To interest accrued and unpaid on mortgages, bonds, and debenture stock, and other loans, to Dec. 31, 18		6.—By sundry stores, ditto	
7.—To sundry tradesmen and others, for amount due for coals, stores, &c., to Dec. 31, 18		7.—By gas and meter rental—balance of this account due to the company on Dec. 31, 18 , less deposits and prepayments	
8.—Wages and contingencies— Amount due to Dec. 31, 18		8.—By coke and other residual—ditto	
To other items (if any)		9.—By sundry accounts—ditto	
		By special items (if any), including investments	
	£		£

Miscellaneous News.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday, July 7—Colonel Hogg in the chair. The Parliamentary Committee presented the following report on the Metropolis Water Bill (No. 2):—

Spring Gardens, July 7, 1871.

Your committee on Friday last reported fully on the subject of the Metropolis Water Bill (No. 2) as it then stood, stating the objections to its provisions and the course which they had considered it expedient to take before the select committee on the bill. On that same day the select committee adjourned until the following Wednesday, to enable the promoters and the water companies to negotiate with a view to arriving at some agreement as to the modifications to be made in the bill. On Monday morning a copy of an amended bill was received from Mr. Wyatt, the promoters agent, with a request that the board would state their views upon it. Your committee met on Tuesday to consider the amendments suggested, and after a careful perusal of them, arrived at the conclusion that they so entirely altered the character of the measure that it was practically a new bill. The bill (No. 2) submitted to the select committee was pronounced by the board to fall far short of what was required to give satisfaction to the consumers of water throughout the metropolis, but the bill as amended by the companies and submitted by Mr. Wyatt was still more unsatisfactory. Indeed, it appeared to your committee to have been drawn up solely to meet the interests of the water companies themselves, and, so far from offering any additional advantages or facilities to the public, it sought to impose upon them more restrictions and vexatious regulations. The name of this board as the controlling authority over the companies, in the interest of the consumers, was altogether struck out. The sole power reserved to them was, to object to the companies regulations, to sue for and receive penalties, and to pay the whole of the costs connected with the passing of the Act. The control over the companies was to be vested in the Board of Trade. They were to appoint a water inspector, or inspectors, who were to be paid by the companies, and to whom large powers were to be given. These officers were to have the power of entry at any time into consumers houses, to see that there were proper fittings, and, if necessary, to enforce the provision of such fittings. A constant house supply was not to be given except on a certificate by the water inspector that four-fifths of the houses on a service were supplied with proper fittings, and then the companies were to have power to cut off and discontinue the supply of water to houses not so certified. A movement for the establishment of a constant house supply could only be initiated by the Board of Trade on a report of water inspector, or by the companies themselves. It will thus be seen that all action by any municipal authority as the direct representative of the inhabitants of the metropolis and guardians of their interests, was to be excluded; and the interest of the public in the matter of water supply were to be entirely in the hands of the companies themselves, and of a Government department acting through the medium of officers paid by the companies. Now, with respect to this proposal to place the control over the companies in the hands of the Board of Trade, and to leave it to them to decide when a constant supply should be given, your committee would refer to the report of the select committee of the House of Commons (of which Mr. Ayrton was chairman), appointed it 1867 to consider the East London Water Bill, and who were also instructed to inquire nto the operation and results of the Metropolis Water Act of 1852. That committee in their report distinctly pointed to the desirability of the water companies being placed under the control of this board, as the central municipal authority, and intimated that in was not the duty of a department of the State to regulate the internal affairs of the metropolis. The following extracts from the report of the select committee suffice to show this. "Your committee recommend that the Metropolitan Board should be empowered to direct from time to time within what period the constant supply should be introduced into each separate street or district;" and further, "It is no part of the legitimate duty of the Board of Trade to watch over the supply of water to the inhabitants of the metropolis. That duty should be performed by local authority with adequate facilities for receiving, and power for enforcing the complaints of individuals." Again, "Your committee therefore recommend that the duty of seeing that the water companies adequately fulfil their obligations should be imposed upon the Metropolitan Board." These and other extracts from the report of the select committee of 1867 were quoted by Mr. Serjeant Sargood, the counsel for the promoters of the bill, in his introductory speech to the committee now sitting; and it was therefore with considerable surprise that your committee perceived a proposal to exclude this board from all control over the companies, and from all means of protecting the interests of the public whom they represent, and to vest the control in a department of the State. But these were not the whole of the alterations made in the bill. The provision for a daily analysis of the water supplied by the companies, to secure that it should be equal to the prescribed standard purity, was struck out, and in place of it was this far from equivalent provision, that the Board of Trade might at any time appoint a competent person to inquire into the quality of the water furnished by any company. It was also proposed to omit from the bill all the clauses relating to the accounts of the companies and their being submitted to the board, and the clauses providing for a public audit of such accounts, at which audit this board might, if they thought fit, be represented. Sufficient has now been said to show that, great as are the shortcomings of the bill (No. 2) referred to the select committee, the amendment and new clauses submitted to the board by Mr. Wyatt, were such as to destroy all of usefulness that remained in it, and were calculated only to give increased power and security to the companies, and to impose restrictions, accompanied by no corresponding benefits, on the consumers. Mr. Wyatt having requested to be at once made acquainted with the views of the board on these suggested amendments, your committee agreed to the following resolution:

"That this committee having considered the Metropolis Water Bill (No. 2) as further amended by the Water Companies, strongly object to the same for the following reasons:—

"That the clauses now introduced so entirely alter the character of the measure that it is practically a new bill.

"That at this period of the session it is too late to enter upon the consideration of a measure of this important character with a view to legislation upon it in the present year.

"That the proposal to place the regulation of the water supply of the metropolis in the hands of the Board of Trade is objectionable, inasmuch as it is no part of the duty of a department of the State to regulate the affairs of any particular district; such duty properly belongs to the municipal or representative body of the district.

"That the placing of so much power as would be given by the new clauses, in the hands of water inspectors, to be appointed by a department of the Government, and paid by the water companies, is calculated to be prejudical to the public, and would be much objected to by them.

"That the effect of the new clauses is to give certain immunities to the companies, while at the same time they do not appear to impose upon them any new responsibilities.

"That the bill, as now altered, appears to be a bill in the interest of the water companies, and not in the interest of the consumers, and is not calculated to be productive of any advantage to the latter.

"That on the grounds above specified, in addition to those set forth in the report of this committee, adopted by the board on the 30th of June, as well as for the reason that the proposals in the bill are at variance with the recommendations of the Royal Commission on water supply, and of the select committee of the House of Commons on the East London Water Bill in 1867, this committee, to whom the subject has been referred by the board, entertain the strongest objections to the bill as it now stands, and are of opinion that it would be much better for the consumers of water that there should be no legislation on the subject this year, than that a bill so ill adapted to meet their just requirements should be passed into law."

Your committee directed the foregoing resolution to be handed to the board's counsel, with instructions to place it before the select committee, and to state that the board would offer to the amended bill a determined opposition. A letter to the same effect was also, in accordance with your committee's instructions, addressed to Mr. Wyatt, in reply to his communication. When the select committee, however, resumed their sittings on Wednesday, it was stated to them by Mr. Serjeant Sargood, on behalf of the promoters of the bill, that the negotiations which had taken place between the promoters and the companies had not resulted in any agreement as to the amendments to be made in the bill, and that it would therefore be for the committee to proceed with the inquiry upon the basis of the bill, as referred to them, leaving it to the companies to propose such amendments as they thought expedient. The promoters then proceeded to call their only remaining witness, Mr. Charles Henry Parkes, upon the question of public audit of the accounts, and upon the conclusion of his evidence, a discussion arose as to which of the opponents—viz., the board or the companies—should first proceed with their case. The companies' counsel urged that the board's case should first be stated, but this was objected to by Mr. Pope, the board's counsel, on the ground that, after he had presented the board's case to the committee, the companies might bring forward and induce the committee to accept clauses and amendments which might have the effect of materially altering the character of the bill so as to render it totally and in every way unacceptable to the board as representing the public interests, and without the public having been heard against it. This view prevailed with the select committee, and they called upon the companies to proceed first. In accordance with this decision, the companies are now producing evidence to the committee. As in the course of the inquiry, proposals may be made by the companies upon which the select committee may require to be made acquainted with the board's views at very short notice, your committee recommend that authority be given to them to come to any decision which may appear to them expedient in the interests of the board and the public, having regard to the views already expressed by the board on the subject.

Mr. NEWTON moved the adoption of the report, and said the bill was one of the most unsatisfactory pieces of attempted legislation.

Mr. DRESSER ROGERS seconded the motion.

Mr. SHAW said the amended bill seemed to meet all the requirements the public had asked. The point in dispute between the board and the companies was that the former desired to have a control over the latter, with the ultimate view of purchasing them up at the expense of the ratepayers, a procedure which would be very unsatisfactory to those who had to pay; whilst the companies desired to maintain the control of the works in their own hands, and for this purpose were willing to grant a constant supply of water where a majority of four-fifths of the residents of premises of the first class desired it, and to force it under penalties on the remaining one-fifth of the residents. Action was to be taken, however, under the Board of Trade, and not under the Board of Works. In the poorer districts the companies proposed erecting stand-pipes, giving a constant supply. He believed the question of a constant supply was not very well understood. What it really meant was, that in first-class premises it would require a considerable outlay; would subject the owner of a house to frequent visits from the water inspector, and a deluge now and then through accidents, and be a great nuisance generally. The stand-pipes would afford an efficient and constant supply to premises of a second class. It was idle to suppose that the water companies having conceded all that was necessary, the board could manage matters any better or more economically. The wisest thing for the board to do would be to confine its opposition to the last clause of the bill, which most unjustly proposed to saddle the overtaxed ratepayers with the expense of bringing in a Government bill, and the pleasure of paying the costs of both sides.

The report was then adopted.

WATER SUPPLY OF THE METROPOLIS.

At the Meeting of the Board, on Friday, July 14—Colonel HOGG in the chair,

The Parliamentary Committee presented the following report upon the proceedings in Parliament in reference to the Metropolis Water Bill:—

The select committee proceeded with their inquiry on the 5th inst., when evidence was called by the companies. On the afternoon of Wednesday, the 10th inst., Mr. Denison handed in to the committee a number of clauses on behalf of the water companies which he said he would have to request the committee to insert as amendments to the bill, and at the same time he handed in an amended bill, in which all the clauses as to constant supply, with one exception, were struck out; also all the clauses as to quality of water and accounts; and the bill contained also further important amendments which, with the new clauses proposed, constituted an entirely new measure, in favour of the water companies. On the 11th inst., the committee declared the preamble of the bill proved, and called upon the promoters to proceed with the clauses. It then appeared that the promoters proposed to amend the bill by making the corporation the metropolitan authority within the City. This was of course opposed by the counsel of the board, but on the conclusion of the argument the committee postponed their decision. The counsel of the board then proposed to amend clause 5 by restoring it to its original form in No. 1 bill, and rendering it obligatory on the companies, upon application of the metropolitan authority, to lay on a constant supply at such pressure as would make the water reach the top story of the highest houses within the water limits. This was strongly opposed by the water companies, and the chairman stated that the committee were not prepared in this respect to modify as against the companies the terms of their various special Acts of Parliament, which define the amount of pressure. A long discussion arose on clause 6, which, in fact, compelled the companies to state their main objections to the bill, and to propose clauses constituting the Board of Trade the controlling authority, and giving various extensive powers to a water inspector, to be appointed by the Board of Trade and paid by the companies. The companies stated that they had the greatest objection to any control being exercised by this board, who might attempt at some future time to purchase the undertakings. The promoters resisted this amendment, and the counsel of the board called attention to the report of Mr. Ayrton's committee of 1867, which distinctly recommended that the control should be vested in this board, and not in the Board of Trade. After clearing the room, the committee stated that they rejected the amendment proposed by the companies, and therefore the companies asked for an adjournment until yesterday afternoon, to consider their position. Upon reassembling yesterday, Mr. Denison said the companies reserved to themselves the power to oppose the bill at any future stage, but would still go on with their objections to clauses, and the committee then proceeded as far as the end of clause 11. It seems probable that the discussion upon the clauses will last some days longer. The counsel of the board continue to watch the bill clause by clause, and to interpose when it seems desirable. In the event of the select committee deciding that as some of the suggestions of the board have been adopted, and they are to be made the controlling authority, the expenses of passing the Act ought to be borne by them, your committee have directed that the board's counsel shall be instructed to insist strongly that the expenses shall be limited to those actually incurred in connexion with the present bill, and shall not embrace the expenses of any inquiries on other matters that may have taken place in previous years.

Mr. E. DRESSER ROGERS said he had hoped that the parliamentary committee would have taken some special notice of the fact that during the past week the committee of the House of Commons had altogether taken from the metropolitan authorities the power of supervision. In the original Bill the local bodies representing the neighbourhood had the power of demanding a constant supply, or rather of putting the power of the Metropolitan Board in motion to obtain a constant supply. Now, however, the local authorities were altogether ousted, and the Metropolitan Board left as the metropolitan authority. And he must ask the members to take the trouble to see how the interests of the consumers of water were altogether ignored. The Metropolitan Board were fighting against the water companies as to which should be the authority and ruling power, and the question as to the price to be paid by the consumers was entirely ignored. He trusted the board would most strenuously continue their opposition to the bill in the House of Lords. He would not allude further to the proposition to make the Board of Trade the authority, but he did sincerely hope the action taken by the different companies would induce Parliament not to pass the bill. If legislation should take place as shadowed forth by the companies, it would be, he thought, the most disastrous thing that could happen. He hoped the question would be taken up on its broad merits, and consumers put on something like an equitable and fair basis, for hitherto, as far as the companies were concerned, it had been a gigantic monopoly.

Mr. NEWTON said he was of opinion they should not allow the water companies and the promoters to thrust a bill upon them, with respect to the construction of which they had had very little to do. They would have a worse bill than they at present ran the risk of having, unless they contested the whole bill clause by clause. They had better have no legislation at all than sham legislation. With respect to price and several other points in the bill it must be remembered that the board had nothing to do with them, for they were not the promoters of the bill, and had no hand in framing it. If they were free to deal with the bill as its promoters, they could say that such and such things must be done or they would withdraw the bill; but unfortunately they did not possess that power, and must go on fighting the clauses or withdraw their appearance and allow the other parties to the bill to do as they liked. He wished the promoters of the bill were stronger in their views, for to his mind they gave way too much to the companies and were not acting sufficiently in the interests of the consumers. The board ought to do its utmost in such a case for the consumers, and that he believed up to the present time they had been doing. He believed the position of the board now was very much better than it was this day last week, and he thought they were indebted to their legal advisers for the positive way in which they had carried out the instructions of the board.

After a word or two from Mr. E. DRESSER ROGERS, the report was ordered to be received and entered on the minutes.

THE TESTING OF GAS-METERS, ETC.

The Works and General Purposes Committee brought up a report upon the method of testing gas-meters, and other matters relating thereto, of which the following is a copy:—

Your committee reported on the 12th of May last, that to enable common air to be used instead of gas for testing meters, they had given directions for a subsidiary air holder to be obtained for each testing-place at a cost of £21 each holder. They have now to report that they have authorized the adoption of a simpler and less expensive arrangement, which consists in merely making small addition to the present holders, rendering any subsidiary holder unnecessary.

Your committee have also to report that a 100-light standard test-meter and a 20-light meter were required for the use of the Shoreditch and Southwark inspectors in testing large meters which could not be removed to the testing-places. They have accordingly given directions for the test-meters to be obtained from Mr. William Sugg, the 100-light meter at a cost of £36, and the 20-light meter at a cost of £15 15s.

Your committee have had their attention directed to the question of allowing a short vacation to the board's gas examiners, for which at present no provision exists.

According to the Acts of Parliament the testings are to be made *daily* throughout the year, and it appears desirable that some arrangement should be made by which each examiner may be allowed a short period for recreation; and a substitute appointed to make the testings during his absence, and also in the event of the absence of any one of them at any time through illness or other unavoidable cause. Your committee recommend that the superintending gas examiner be authorized to arrange for each examiner to have about a fortnight's vacation, no two examiners being away at any one time, and that he be also authorized to make arrangements for the testings to be made by a substitute during the absence of any examiner, such substitute being paid at the rate of seven shillings a day.

The report was received, adopted, and ordered to be entered on the minutes without any discussion taking place upon it.

The board then adjourned.

SHEERNESS BOARD OF HEALTH AUDIT.

Several objections having been raised to certain items included in the accounts of the Board of Health made up to March 25, 1871, the auditor, HENRY BATHURST, Esq., attended at the Board Room, on Thursday, July 6, for the purpose of considering such objections. A number of ratepayers were present.

Mr. MARKS, on behalf of himself and other ratepayers, handed in a list of objectionable items, which were as follows:—

Expenses relating to the Clock and Tower.

			£	s.	d.
April 19, 1870.	—Mr. Benson, for turret clock, bell, and fixing		145	0	0
May 9,	,, Mr. Nunn, for fitting clock with gas		10	5	1½
June 13,	,, Mr. Munn, for winding clock		0	7	6
Sept. 15,	,, Mr. Copland, for taking opinion of counsel as to clock tower		5	1	5
Oct. 22,	,, Mr. Beal, for plan of clock tower		5	5	0
Jan. 14, 1871.	—Mr. Miller, for altering board-room to receive clock		103	0	0
Mar. 20,	,, Mr. Kuner, for improving clock		1	15	6
			270	14	6½

Expenses relating to Gas Opposition.

			£	s.	d.
Sept. 6, 1870.	—Mr. Mudd, for disbursements for help—viz., assistance in office duty		0	7	0
Nov. 25,	,, Messrs. Hickmott and Co., for plans and specifications of gas-works		21	0	0
Dec. 17,	,, Mr. Mudd, for assistance in drawings of gas plans		1	14	0
Jan. 14, 1871.	—Mr. Mudd, for assistance in gas plans		1	0	0
Mar. 18,	,, Mr. Felkin, for expenses to London to instruct Messrs. Durnford and Co. to oppose the Sheppy Gas Company's Bill		0	16	0
	Total	295 11s. 6½d.	324	17	0

With respect to the first item of £145, Mr. Marks called the attention of the auditor to 11 & 12 Vict., c. 63, s. 85, which provided that all contracts necessary for carrying this (the Public Health) Act into execution should be made in conformity with certain conditions; that is, first, every contract exceeding £10 value should be in writing, under the seal of the board, and signed by five or more members; secondly, the surveyor should prepare an estimate in writing, with a report, &c.; thirdly, before any contract exceeding the value of £100 is entered into, tenders must be invited, and ten days notice of their receipt given, &c. Mr. Marks contended that this form of procedure had not been complied with in the purchase of the clock, and that the mode of its purchase was illegal and irregular from beginning to end. He stated the full particulars of how the clock really was purchased and paid for by one member of the board, presumably under the advice of the chairman.

The CLERK (Mr. Felkin), argued, on behalf of the board, that they had the power to make a purchase, that is, order goods and pay for them, without complying with the requirements of the sections quoted, as that process would not be a contract.

Mr. MARKS said that the selection and purchase of the clock by one member, who fancied that he had authority to do so, would not be a compliance with the section, but the clock bought was not the one for which Mr. Benson first gave a price, and the whole transaction was unprecedented and illegal. He further objected that the provisions of sec. 98, requiring that the estimate of every rate should show the purposes for which the money was provided, had not been complied with.

The AUDITOR, after investigation, said that in his opinion the objections made by Mr. Marks were valid, and the whole of the items relating to the clock must be disallowed, on the ground that there should have been a contract in the form prescribed by section 85.

Mr. MARKS asked if this decision included the gas-fittings, and the erection of the clock tower on the board-room. He said the pretence of calling the erection over head "an alteration of the board-room" was a subterfuge, and he thought it was not likely to mislead the auditor. The board had only one section empowering them to erect a clock, and that section clearly gave no power to erect a

clock tower. This the board knew, but unfortunately, the only law to which the board gave any heed was the will of the chairman; the counsel's opinion, for which £5 was paid, only told them that two and two made four, an opinion he would have given them gratis. In defiance of this counsel's opinion, they put up this wooden tower, and this was clearly illegal.

The AUDITOR said it was a mistake to take counsel's opinion on a section which was quite clear in itself, and it was a waste of public money. The board had no power, under 21 & 22 Vict., c. 98, s. 45, or 10 & 11 Vict., c. 34, s. 143, to erect a clock tower or obtain plans for one.

Mr. NIXON called attention to another item of expense caused by the removal of the clock.

The AUDITOR said he should disallow the whole of the items objected to, as there was no doubt in his mind they were illegal payments.

Mr. MARKS then called the attention of the auditor to the items of expenditure relating to the gas plans advertised for. The board had no power, under any general Act, to build gas-works, but even if they simply wished to know the probable cost, this might have been had without a shilling expense. The powers relied on as being unrepealed in the old Towns Improvement Act, only applied to a portion of the district at any time, and they were now inoperative. The chairman's law in this was possibly satisfactory to the board, but he was sure it would not suit the auditor.

The AUDITOR, after examining the old Towns Act, and pointing out the want of any authority either in that or elsewhere to expend money on erecting gas-works, stated he was bound to disallow both the premium paid to Messrs. Hickmott and Co. and the smaller amounts.

On the question being raised as to the appearance of this £21 in any estimate, The CLERK said it was included under the head of "Miscellaneous."

The AUDITOR said this was a very improper proceeding; clauses 85 and 98 had neither of them been complied with, and those objections would be fatal even if the scheme of erecting gas-works had been within the board's powers.

With respect to the item of 16s. expenses of the clerk in going to London to instruct Messrs. Durnford and Co. to oppose the Sheppy Gas Bill, the auditor asked if other expenses has since been incurred in that opposition.

The CLERK explained the proceedings of the board in the matter, and the grounds on which the board's opposition was based.

The AUDITOR said if they came before him he should be bound to disallow all such payments, as they were clearly illegal. The 16s. he should now disallow. Other grounds of objection which Mr. Marks had urged he did not think it necessary to go into, the points dealt with were sufficient for the purpose.

The ratepayers present thanked the auditor for his courtesy and attention.

The AUDITOR said he had only done his duty as he was bound to do it, on the facts brought before him.—*Sheerness Times.*

LECTURE ON THE ANALYSIS OF COAL GAS.

By H. LETHEBY, M.B., M.A., &c.,
Professor of Chemistry in the College of the London Hospital, and Chief Gas Examiner for the Metropolis.

[*Delivered before the British Association of Gas Managers at Dublin, Tuesday, June* 13.]

Mr. President and Gentlemen,—At the meeting of this association at Birmingham in the month of May, 1865, when I had the honour of giving my second lecture on the "Chemistry of Gas Lighting," I directed your attention to the compound, or rather complex, nature of coal gas; and, after showing you experimentally the leading properties of each of its most important constituents, I described very briefly the means of discovering them. To-night, at your request, I have to resume the subject, and will enter, with more detail, into the processes which are used for the analysis of coal gas.

And, first, let me remind you what are the chief constituents of such gas, for these are the bodies to be sought for. In my former lecture, as some of you may perhaps remember, they were classified under the following heads:—

1. *The Combustible Non-Illuminating Constituents.*
2. *The Illuminating Hydrocarbons.*
3. *The Non-Essential Constituents, or Impurities.*

The first of these are *Hydrogen* (H) and *Carbonic Oxide* (C O), which, together, amount to from 30 to 60 per cent. of the gas, according to its quality.

The second are *Marsh Gas* or *Methyl-hydride* (CH_4), and perhaps other members of the series, as *Ethyl-hydride* (C_2H_6), *Propyl-hydride* (C_3H_8), *Butyl-hydride* (C_4H_{10}), and *Amyl-hydride* (C_5H_{12}); next, the Olefiant gas series, in which the volume of carbon is half that of hydrogen, as *Methylene* (CH_2), *Ethylene* (C_2H_4), *Propylene* (C_3H_6), *Butylene* (C_4H_8), and *Amylene* (C_5H_{10}); then comes the Benzole series, in which the proportion of carbon is still larger, as *Benzole* (C_6H_6), *Toluole* (C_7H_8), *Xylole* (C_8H_{10}), *Cumole* (C_9H_{12}), and *Cymole* ($C_{10}H_{14}$); and, lastly, others still richer in carbon, as *Acetylene* (C_2H_2), *Naphthalin* ($C_{10}H_8$), and *Anthracin* ($C_{15}H_{10}$).

The third group of constituents are *Carbonic Acid* (CO_2), *Oxygen* (O), *Nitrogen* (N), *Ammonia* (NH_3), *Bisulphide of Carbon* (CS_2), *Sulpho-hydrocarbons* (?), *Sulphuretted Hydrogen* (H_2S), and *Aqueous Vapour* (H_2O).

The composition, specific gravity, and combustion products of these constituents of coal gas are shown in the following table:—

TABLE No. 1.—*Composition, Specific Gravity, and Combustion Products of the Chief Constituents of Coal Gas.*

Name of Constituent.	Symbol or Formula.	Constituents per Volume. C (Vol.)	Constituents per Volume. H (Vol.)	Specific Gravity of the Gas or Vapour.	Weight of a Cubic Foot. (Grains.)	Vol. of Oxyg. required to Burn 1 Vol.	Prodcts. of Combustn. CO_2 (Vol)	Prodcts. of Combustn. H_2O (Vol)
Atmospheric air	...	..	..	1·000	536·28	..	..	..
Hydrogen	H	..	..	0·069	37·00	0·5	..	1·0
Nitrogen	N	..	..	0·971	520·73	..	..	..
Oxygen	O	..	..	1·106	593·13	..	..	..
Ammonia	NH_3	..	1·5	0·590	317·41	0·75	..	1·5
Aqueous vapour	H_2O	..	..	0·622	333·57	..	..	..
Carbonic oxide	C O	0·5	..	0·967	518·58	0·5	1·0	..
Carbonic acid	CO_2	..	..	1·520	815·15	..	..	..
Cyanogen	C N	1·0	..	1·801	965·84	2·0	2·0	..
Sulphuretted hydrogn.	H_2S	..	1·0	1·175	630·13	1·5	..	1·0
Bisulphide carbon	CS_2	0·5	..	2·645	1418·46	3·0	1·0	..
Marsh Gas Series—								
Methyl-hydride	CH_4	0·5	2·0	0·553	296·66	2·0	1·0	2·0
Ethyl-hydride	C_2H_6	1·0	3·0	1·037	556·12	3·5	2·0	3·0
Propyl-hydride	C_3H_8	1·5	4·0	1·522	816·22	5·0	3·0	4·0
Butyl-hydride	C_4H_{10}	2·0	5·0	2·005	1075·24	6·5	4·0	5·0
Amyl-hydride	C_5H_{12}	2·5	6·0	2·489	1334·80	8·0	5·0	6·0
Olefiant Gas Series—								
Methylene	CH_2	0·5	1·0	0·484	259·56	1·5	1·0	1·0
Ethylene	C_2H_4	1·0	2·0	0·968	519·12	3·0	2·0	2·0
Propylene	C_3H_6	1·5	3·0	1·452	778·68	4·5	3·0	3·0
Butylene	C_4H_8	2·0	4·0	1·936	1038·24	6·0	4·0	4·0
Amylene	C_5H_{10}	2·5	5·0	2·419	1297·26	7·5	5·0	5·0
Benzole Series—								
Benzole	C_6H_6	3·0	3·0	2·695	1445·27	7·5	6·0	3·0
Toluole	C_7H_8	3·5	4·0	3·179	1704·83	9·0	7·0	4·0
Xylole	C_8H_{10}	4·0	5·0	3·663	1964·39	10·5	8·0	5·0
Cumole	C_9H_{12}	4·5	6·0	4·147	2223·95	12·0	9·0	6·0
Cymole	$C_{10}H_{14}$	5·0	7·0	4·632	2484·05	13·5	10·0	7·0
Acetylene	C_2H_2	1·0	1·0	0·898	481·57	2·5	2·0	1·0
Naphthalin	$C_{10}H_8$	5·0	4·0	4·423	2371·97	12·0	10·0	4·0
Anthracin	$C_{15}H_{12}$	7·5	6·0	6·635	3558·22	18·0	15·0	6·0

It will be seen from this that the specific gravity of coal gas is entirely dependent upon the proportions of its leading constituents; that, in fact, as the gas becomes richer and richer in hydrocarbons, and therefore of higher illuminating power, its density or specific gravity increases. When, for example, it is chiefly composed of hydrogen and marsh gas, or methyl-hydride, as is the case with gas of low illuminating power, its density must necessarily be low, for the specific gravity of hydrogen is only 69 (atmospheric air being 1000), and of marsh gas, 553; whereas the denser hydrocarbons range from a gravity of 968 to 6635. The specific gravity of coal gas is, therefore, an indication of its composition, and is, indeed, the first step of its analysis. Let me, then, show you how this is determined, and what are the precautions necessary to ensure accurate results.

Specific Gravity of Gas.

This really means the relative weight of any volume of gas to the weight of the same volume of dry atmospheric air, at the same temperature and pressure as the gas. If, therefore, I take this glass globe, which is full of dry air, and counterpoise it accurately in the balance, I obtain, as you see, the exact weight of the globe and its contents (the dry air). I now exhaust it by means of the air-pump, and on returning it to the balance I find it has lost 34 grains in weight, which is manifestly the weight of the volume of atmospheric air which I have removed. Let me, in the next place, attach the exhausted globe to a stop-cock which is delivering coal gas; and having admitted the gas into the vacuum of the globe, I obtain a volume of gas which is equal to that of the air removed. Supposing that, after proper precautions, the temperature and pressure of the gas in the globe are exactly the same as they were in the case of the dry atmospheric air before its removal, it is evident that the weight of the gas, compared with that of the dry air, will be the exponent of its specific gravity, for these are the relative weights of equal volumes of gas and air under the same conditions of temperature and pressure. I, therefore, return the globe to the balance, and find that the gas which has been admitted weighs 17·8 grains; and thus I ascertain that the relative weights of equal volumes of gas and dry atmospheric air—supposing them to be under the same conditions of temperature and pressure—are 17·8 and 34. These are also the relative proportions of their specific gravities; for, as 34 (the weight of the dry air) is to the specific gravity of atmospheric air (1000), so is 17·8 (the weight of the gas) to the specific gravity of the gas (523).

But, to obviate the necessity of exhausting the globe at each operation, I generally use this double-necked globe, which is kept constantly attached to a gas-pillar; and as the gas is always passing through it, it is always ready for weighing, there being a thermometer in the outlet-tube from the globe which shows the temperature of the gas. Once for all the balance of the empty globe and the weight of the globe full of dry air, at a temperature of 60° Fahr. and a pressure of 30 inches of the barometer, have been determined, and thus I am in a condition to ascertain the specific gravity of the gas at any moment.

A rude but handy method of ascertaining approximatively the specific gravity of coal gas was devised by the late Mr. Alexander Wright, of Westminster. It consists of a light balloon, capable of holding a cubic foot of gas, and of a series of weights representing in units the 1000th part of the weight of a cubic foot of dry atmospheric air. The first step of the experiment is to expel the air from the balloon, by folding it up in the form in which it is kept packed in the box, and then ascertaining its weight in a delicate balance with the weights supplied. It is then filled with gas, and, being lighter than atmospheric air, it has a tendency to rise. Weights are then put into the little car of the balloon until it is exactly balanced in the air, and will neither rise nor fall. These weights, together with the weight of the balloon and car, represent the weight of the same volume (a cubic foot) of atmospheric air; and, supposing that the temperature of the gas was the same as that of the air, the difference between these weights and 1000 (the weight of the air) represents the specific gravity of the gas; for say it required 477 of the weights (including the weight of the balloon and car and the weights put into the car) to balance 1000 of air, it follows that the cubic foot of gas in the balloon must have weighed 523, for these are the weights necessary to make up the 1000, and therefore the relative weights of equal volumes of air and gas under the same conditions of temperature and pressure must have been 1000 and 523, which are their relative specific gravities.

In practice, however, it is rarely found that the temperature and pressure of the gas at the time of the experiment correspond with the standard temperature of 60° Fahr. and the standard pressure of 30 inches of the barometer, at which the weight, and consequently the specific gravity, of atmospheric air is estimated. It is necessary, therefore, to resort to calculation for the purpose of reducing the experimental weight of the gas at the observed temperature and pressure to what it would be at the standard temperature and pressure. Fortunately this is not a difficult process, for, as regards pressure, it is known that the weight of a given bulk of gas is always directly proportional to the pressure; for the greater the pressure upon the gas, the more of it will be forced into a given bulk. If, therefore, a globe full of gas weighs 17·2 grains at a pressure of 29·2 inches of the barometer, it will hold 17·69 grains of the gas at a pressure of 30 inches of the barometer; for—

As 29·2 : 17·2 :: 30 : 17·69.

And thus we correct for *weight and pressure*. On the other hand, if it be required to correct *the volume* of the gas *for pressure*, the rule must obviously be an inverse one, because the bulk of any gas is always inversely as the pressure—the greater the pressure the less the bulk; 100 volumes of gas, therefore, at 29·2 inches of the barometer, will be only 97·33 volumes at 30 inches of the barometer, for—

As 30 : 100 : : 29·2 : 97·33.

In this way we correct for bulk and pressure.

Again, corrections for temperature are founded on the fact that every gas expands the 1-491·13th part of its bulk at 32° Fahr. for every degree of heat above that temperature. This is the result of the careful investigation of M. Regnault, whose number, representing the rate of expansion of gases, is nearer the truth than that of Gay Lussac and Dalton (the 1-480th part), or of Rudberg (the 1-493rd part). For all practical purposes, however, it is sufficiently near to the truth if we regard the rate of expansion as the 1-491st part of the bulk of the gas at 32° for every degree of Fahrenheit above that temperature. Suppose, therefore, that at the time of making the experiment the globe full of gas weighed 17·2 grains, when the pressure of the barometer was only 29·2 inches, and the temperature of the gas was 66·4° of Fahrenheit, the problems to be solved are—

1. What would have been the *weight* of the globe full of gas at the standard pressure of 30 inches of the barometer, and the standard temperature of 60° Fahr.? and
2. What would have been the *bulk* of the gas at that pressure and temperature?

The mode of proceeding, in each case, is as follows:—First, correct the weight and bulk of the gas for pressure; and thus we find, as in the illustrations already given, that at 30 the weight of the globe full of gas would have been 17·69 grains, and its bulk 2·67 per cent. less than at 29·2 of the barometer (100 volumes becoming 97·33 volumes). Then correct for temperature, using, for this purpose, the figures last obtained; and, as the rate of expansion only applies to the bulk of the gas at 32°, it is necessary to use a process whereby the volumes at each temperature may be reduced to a common denomination. This is accomplished by assuming that 491 volumes of the gas, at 32° Fahr., were the subjects of experiment in each case, and that the rate of expansion was the $\frac{1}{491}$ part of the volume at 32° for every degree of Fahrenheit above it. It follows, therefore, that 491 volumes of gas at 32° would become 525·4 volumes at 66·4°, which is the observed or experimental temperature (*for* 66·4 − 32 + 491 = 525·4), and 519 volumes at 60°, which is the required or standard tem-

perature (for 60 — 32 + 491 = 519). Now, as the bulk of the gas is directly as the temperature (according to this rate), it follows that 97·33 volumes of gas at 66·4° would become 96·14 volumes at 60°; for—

66·4	60·0
32·0	32·0
34·4	28·0
491·0	491·0

As 525·4 : 97·33 :: 519·0 : 96·14

But, in correcting the weight of a given volume of gas for temperature, the process is reversed, because, as the temperature rises, the volume increases; and hence a given bulk of the gas weighs less. If, therefore, the globe of gas at 66·4° Fahr., and at 30 inches of the barometer, weighed 17·69 grains, it is manifest that the same volume of gas at 60° would weigh 17·91 grains; for—

As 519 : 17·69 :: 525·4 : 17·91

The weight, therefore, of the gas, at a pressure of 29·2 inches of the barometer, and at a temperature of 66·4° Fahr., which were the experimental numbers, would be increased from 17·2 grains to 17·91, by correcting it to the standard pressure (30 bar.) and temperature (60° Fahr.).

To facilitate these corrections, by obviating the difficulties of calculations, a table has been constructed, of which this is a copy, giving the volumes at different temperatures and pressures of 1000 parts of gas at the standard temperature and pressure. This table is most useful, when it is required, in photometrical observations, to correct the volume of gas as it traverses the meter in a warm room, for it shows at a glance the standard volume of the warm gas:—

TABLE No. 2.—*Correction of the Volume of Gas at different Temperotures, and under different Atmospheric Pressures.*

Bar.	Ther. 40°	42°	44°	46°	48°	50°	52°	54°	56°	58°	60°	62°	64°	66°	68°	70°	72°	74°	76°	78°	80°	82°
28·0	·971	·967	·963	·960	·956	·952	·948	·944	·941	·937	·933	·930	·926	·922	·919	·915	·911	·907	·904	·900	·897	·893
28·1	·974	·970	·967	·963	·959	·955	·952	·948	·945	·941	·937	·933	·929	·926	·922	·919	·914	·911	·907	·904	·900	·896
28·2	·978	·973	·970	·968	·963	·959	·955	·951	·947	·944	·940	·936	·933	·929	·925	·922	·917	·914	·911	·907	·903	·899
28·3	·982	·977	·974	·970	·966	·963	·958	·955	·951	·947	·943	·940	·936	·932	·929	·925	·921	·917	·914	·911	·906	·902
28·4	·985	·980	·978	·973	·970	·966	·962	·958	·954	·951	·947	·943	·939	·936	·932	·928	·924	·920	·917	·914	·910	·905
28·5	·988	·984	·980	·978	·973	·970	·965	·961	·958	·954	·950	·946	·943	·939	·935	·932	·927	·923	·920	·917	·913	·909
28·6	·992	·987	·984	·980	·976	·973	·969	·965	·961	·957	·953	·950	·946	·942	·939	·935	·931	·927	·923	·919	·916	·912
28·7	·995	·991	·987	·983	·980	·976	·972	·968	·964	·961	·957	·953	·949	·945	·942	·938	·934	·930	·926	·922	·919	·915
28·8	·998	·995	·991	·987	·983	·980	·976	·971	·968	·964	·960	·956	·952	·949	·945	·941	·937	·934	·929	·925	·922	·918
28·9	1·002	·998	·994	·991	·987	·983	·979	·975	·971	·968	·963	·960	·956	·952	·948	·944	·940	·937	·933	·928	·925	·921
29·0	1·006	1·001	·998	·994	·990	·986	·982	·978	·974	·971	·967	·963	·959	·955	·952	·948	·943	·940	·936	·932	·928	·925
29·1	1·009	1·004	1·001	·998	·993	·989	·985	·982	·978	·974	·970	·966	·962	·959	·955	·951	·947	·943	·939	·935	·932	·928
29·2	1·012	1·008	1·004	1·001	·997	·993	·989	·985	·981	·977	·973	·969	·966	·962	·958	·954	·950	·947	·942	·938	·935	·932
29·3	1·016	1·011	1·007	1·004	1·000	·996	·992	·988	·984	·981	·977	·973	·969	·965	·961	·957	·953	·950	·946	·941	·938	·935
29·4	1·019	1·015	1·011	1·008	1·004	1·000	·996	·992	·988	·984	·980	·976	·972	·969	·965	·961	·956	·953	·949	·945	·941	·938
29·5	1·023	1·018	1·014	1·011	1·007	1·004	1.000	·995	·991	·987	·983	·979	·975	·971	·968	·964	·960	·956	·952	·948	·945	·941
29·6	1·026	1·022	1·018	1·015	1·010	1·006	1·002	·998	·994	·991	·987	·982	·979	·975	·971	·967	·963	·959	·955	·952	·948	·945
29·7	1·030	1·025	1·021	1·018	1·014	1·010	1·006	1·002	·997	·994	·990	·986	·982	·978	·974	·970	·966	·962	·959	·955	·951	·948
29·8	1·033	1·029	1·025	1·022	1·017	1·013	1·009	1·005	1·001	·997	·993	·989	·985	·981	·977	·974	·970	·966	·962	·958	·954	·951
29·9	1·037	1·032	1·028	1·025	1·021	1·017	1·013	1·009	1·004	1·001	·997	·992	·989	·985	·981	·977	·973	·969	·965	·961	·957	·954
30·0	1·040	1·036	1·032	1·028	1·024	1·020	1·016	1·012	1·008	1·004	1·000	·996	·992	·988	·984	·980	·976	·972	·968	·964	·961	·957
30·1	1·043	1·039	1·035	1·032	1·028	1·023	1·019	1·015	1·011	1·007	1·004	·999	·995	·991	·987	·983	·979	·975	·972	·968	·964	·960
30·2	1·047	1·043	1·039	1·035	1·031	1·027	1·023	1·019	1·015	1·011	1·007	1·003	·998	·994	·990	·987	·983	·979	·975	·971	·967	·963
30·3	1·051	1·047	1·043	1·039	1·034	1·030	1·026	1·022	1·018	1·014	1·010	1·006	1·002	·998	·994	·990	·986	·982	·978	·974	·970	·966
30·4	1·054	1·050	1·046	1·042	1·038	1·034	1·029	1·026	1·021	1·017	1·013	1·009	1·005	1·001	·997	·993	·989	·985	·981	·977	·974	·969
30·5	1·058	1·053	1·050	1·045	1·041	1·037	1·033	1·029	1·025	1·021	1·017	1·012	1·008	1·004	1·000	·997	·993	·989	·984	·980	·977	·973
30·6	1·061	1·056	1·053	1·049	1·045	1·040	1·036	1·032	1·028	1·024	1·020	1·016	1·012	1·008	1·004	1·000	·996	·992	·988	·984	·980	·976
30·7	1·064	1·060	1·056	1·052	1·048	1·044	1·040	1·036	1·031	1·027	1·023	1·019	1·015	1·011	1·007	1·003	·999	·995	·991	·987	·983	·979
30·8	1·068	1·063	1·060	1·056	1·051	1·047	1·043	1·039	1·035	1·031	1·027	1·022	1·018	1·014	1·010	1·006	1·002	·999	·994	·990	·986	·982
30·9	1·072	1·067	1·063	1·059	1·055	1·051	1·046	1·043	1·038	1·034	1·030	1·026	1·022	1·017	1·014	1·010	1·006	1·002	·997	·993	·990	·985
31·0	1·075	1·070	1·067	1·063	1·058	1·054	1·051	1·046	1·042	1·037	1·033	1·029	1·025	1·021	1·017	1·013	1·009	1·005	1·000	·996	·993	·989

The Calculations from which this Table has been drawn up are based on the experiments of Dulong, Regnault, and Mangus.

Other corrections are necessary when it is required to know the proportion of moisture in gas standing over water, as is the case in an ordinary gasholder; for, under these circumstances, the quantity of aqueous vapour is influenced by the temperature and pressure of the gas. These corrections are founded on the results of careful observations as to the volume and weight of aqueous vapour in gas saturated with moisture at all common temperatures, and the general conclusions may be thus expressed:—

1. The volume of gas is increased by the presence of aqueous vapour.
2. Its weight is also affected by it, according as the specific gravity of the gas is greater or less than that of aqueous vapour; and
3. Its elastic force or pressure is likewise influenced by the weight of the aqueous vapours.

These facts are represented in the following table:—

TABLE No. 3.—*Amounts of Aqueous Vapour, by Weight and Volume, in a Cubic Foot of Gas over Water, as in a common Gasholder, and the Elastic Force of it, in Inches of Mercury, at different Temperatures.*

Temp.	Weight of the Aq. Vap.	Expansion from Aq. Vap.	Elastic Force of Aq. Vap.	Temp.	Weight of Aq. Vap.	Expansion from Aq. Vap.	Elastic Force of Aq. Vap.
Deg. F.	Grs.	Per Cent.	In.	Deg. F.	Grs.	Per Cent.	In.
22	1·4	0·39	0·118	71	8·3	2·60	0·759
24	1·5	0·43	0·129	72	8·5	2·69	0·785
26	1·7	0·47	0·141	73	8·8	2·79	0·812
28	1·8	0·51	0·153	74	9·1	2·88	0·840
30	2·0	0·56	0·167	75	9·4	2·98	0·868
32	2·1	0·60	0·181	76	9·7	3·08	0·897
34	2·3	0·65	0·196	77	10·0	3·19	0·927
36	2·5	0·71	0·212	78	10·3	3·30	0·958
38	2·7	0·77	0·229	79	10·6	3·41	0·990
40	2·9	0·83	0·247	80	11·0	3·52	1·023
42	3·1	0·89	0·267	81	11·3	3·65	1·057
44	3·3	0·96	0·288	82	11·7	3·78	1·092
46	3·6	1·05	0·311	83	12·0	3·91	1·128
48	3·8	1·13	0·335	84	12·4	4·05	1·165
50	4·1	1·21	0·361	85	12·8	4·19	1·203
52	4·4	1·31	0·388	86	13·2	4·32	1·242
54	4·7	1·41	0·418	87	13·6	4·46	1·282
56	5·0	1·52	0·449	88	14·0	4·61	1·323
58	5·4	1·64	0·482	89	14·4	4·77	1·366
60	5·8	1·76	0·518	90	14·8	4·93	1·410
61	6·0	1·82	0·537	91	15·3	5·10	1·455
62	6·2	1·88	0·556	92	15·7	5·26	1·501
63	6·4	1·96	0·576	93	16·2	5·44	1·548
64	6·6	2·03	0·596	94	16·7	5·62	1·596
65	6 8	2·10	0·617	95	17·2	5·81	1·646
66	7·0	2·18	0·639	96	17·7	6·00	1·697
67	7·3	2·25	0·661	97	18·2	6·20	1·751
68	7·5	2·33	0·684	98	18·7	6·41	1·806
69	7·8	2·42	0·708	99	19·3	6·61	1·862
70	8·0	2·50	0·733	100	19·8	6·83	1·918

Let us suppose, then, that we have 100 cubic inches of gas over water, and therefore saturated with moisture, at a temperature of 65° Fahr., and that it weighed 18 grains—a cubic foot of it (1728 cubic inches) would weigh 311 grains; and, by referring to the table, we find that 6·8 grains are attributable to the moisture in it; so that the weight of the dry gas is 304·2 grains; and therefore, 100 cubic inches of the moist gas, weighing 18 grains, would contain 17·6 grains of dry gas. Now as the volume of the gas has been increased by the moisture, at the rate of 2·1 per cent., the volume of the dry gas must have been 97·94 cubic inches; and thus we obtain the weight and bulk of the dry gas in 100 cubic inches of gas saturated with moisture.

Another method of correcting for moisture is by means of the data furnished by the elastic force of aqueous vapour at different temperatures; for as the barometric pressure of the moist gas at the time of the experiment is made up of the combined pressure or weight of the dry gas and the aqueous vapour, it is manifest that the relative bulks of the two must be in the same proportion; and hence it follows that the total pressure of the dry gas and aqueous vapour must be to the partial pressure, or elastic force of the aqueous vapour, as the total bulk of the two is to the partial bulk of the aqueous vapour. Suppose, therefore, by way of illustration, that we have been experimenting with 100 cubic inches of gas saturated with moisture at a temperature of 65° Fahr., and a pressure of 29·2 of the barometer. On reference to the table, we find that the elastic force of aqueous vapour at that temperature is 0·617 of an inch of mercury; and as 29·2 (the total pressure) is to 0·617 (the pressure of the aqueous vapour), so is 100 (the total bulk of the gas and aqueous vapour) to 2·11 (the bulk of the aqueous vapour). And when this is corrected for pressure and temperature, so as to bring it from 29·2 bar. and 65° Fahr. to 30 bar. and 60° Fahr., we are able to determine the standard bulk of the aqueous vapour in the gas; and this enables us to determine its weight, for a cubic inch of aqueous vapour, at 30 inches of the barometer and at 60° Fahr., weighs 0·1929 of a grain.

(*To be continued.*)

BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page 518.*)

TUESDAY, JUNE 13.

At the evening sitting, Dr. Letheby delivered a lecture "On the Analysis of Coal Gas," the first portion of which is reported in another column.

WEDNESDAY, JUNE 14.

The President took the chair at eleven o'clock this morning.

Mr. JAMES ELDRIDGE (Richmond) read the following paper:—

ON THE APPARATUS FOR, AND METHOD OF, MANUFACTURING SULPHATE OF AMMONIA SUITABLE FOR SMALL GAS-WORKS.

When we met at Nottingham in 1867, Mr. Esson and Mr. Anderson read papers on the manufacture of sulphate of ammonia. I felt much interested in them, because the works of which I have the charge are nearly a mile from either river or rail, and we were for years obliged to dispose of our liquor at a loss; this led me to attach considerable importance to the valuable suggestions made by those gentlemen. Since then I have erected a small plant which has proved so successful that, with the permission of our committee, I beg to lay before you a brief description of it, with the results of its working.

My remarks are especially designed for the consideration of those who are managers of comparatively small works, who find their liquor a source of trouble, and the returns for which are not satisfactory.

Mr. ANDERSON says (page 14, report of 1867): "Numerous gas companies find their ammoniacal liquor a nuisance, and the respective communities they supply are universally getting more sensitive in the nose, so that unless it can be sold or given away, the question of what is to be done with it is becoming every day most urgent." This was just the case with us; we could sell it, but the price realized did not pay the cost of its removal from the works to the barge, and we were threatened with legal proceedings for conveying it through the village to the waterside. Some gas companies put it in their pits, with what destructive results I need not state. Some that I know dig a deep well and let it sonk away into the earth, and eventually into wells in the neighbourhood.

I have had my small apparatus in operation about two years. There is nothing new in its general principles; it is much the same as Mr. Anderson's, shown in plate No. 5, in the report of 1867, and as described by Mr. Esson, page 20, when he says: "A step in advance of this arrangement is that one in which the liquor is pumped into a boiler. Along with the liquor, a proper quantity of shell-lime is put, which sets free the fixed ammonia. From this boiler a suitable pipe conducts the ammoniacal steam to a saturating vessel of proper construction, lined with lead, and into which the sulphuric acid is put. The salts formed in the saturator are removed as they form, and more acid added as the case demands."

I do not say that the plan I have adopted is the most economical where you have to make a very large quantity, but I have found it has the following important advantages:—It is very simple, requires no steam, very little attention, and is free from offensive smell. I will now give you a brief description of it, with results as to profit, compared with our former mode of disposing of our liquor.

The gas is scrubbed with liquor till it shows about 7° of strength on Twaddle's hydrometer, or about 15 ozs. of liquor. It is then pumped into a settling-tank, from which it is conveyed through a pipe laid to a fall into a boiler 9 feet by 4 feet, which will work off about 500 gallons.

As it does not require a very great heat, the boiler is set over an ordinary furnace on a 4½-inch brick arch, so that no fire comes in direct contact with the boiler. Connected to the boiler, and leading to the saturator, is a 2-inch pipe, the

top part of which is iron, and the bottom part is lead in the shape of a T, and is perforated.

The saturating-tank is then charged with brown acid of about 80°, the first charge of which is diluted with about 3 gallons of water to a hundredweight of acid; but afterwards we use mother liquor instead of water. Upon the application of heat to the boiler, the ammoniacal steam is driven over through the 2-inch pipe into contact with the acid. In about 18 hours the whole of the ammonia (or nearly the whole) will be driven over from the liquor into the boiler, and formed into salts at the bottom of the saturator; the spent liquor is then run off from the boiler, and the salts removed with the liquor into a cooling-pan, the saturator and boiler being again ready for charging in the same way. This occupies but a short time, and they are soon at work again. The salts are fished out of the cooling-pan and laid on a sloping tank lined with lead, the foot of the incline being perforated, so that the liquor may be drained from it and applied to the next charge. The process thus goes on every day except Sunday. As soon as the salts are sufficiently dry, they are put into a storeage-tank lined with lead, with an outlet at the bottom to carry off any small amount of moisture that may still be left in them; by this means we have no loss from the dissolving of the salts through damp weather and other causes.

In order to prevent any perceptible diffusion of objectionable gases, the saturating-tank is provided with a wooden covering, and in it is fixed a 6-inch pipe, the upper end of which is built into the chimney. The whole of the sulphuretted hydrogen is effectually carried off through this pipe into the chimney, so that there is really nothing offensive in the process.

Financially, the results may be stated in my case thus:—

To Acid	£160	0	0	By 34 tons sulphate at £15, less 2½ per cent.....	£497	5	0
Labour	25	0	0				
Fuel	10	0	0				
Profit	302	5	0				
	£497	5	0		£497	5	0

We thus realized a net profit of £302 5s., a sum not to be despised, particularly when we consider that it arose from the conversion of what might otherwise have been an intolerable nuisance.

Before I commenced, I not only studied the papers to which I have alluded, but visited several works where it was made, and in my opinion the process adopted by Mr. Stout, of Boston, was the best. Mine is very similar, differing only in a few details, which I think are improvements.

I am aware these few plain remarks on rather an important subject are not of that scientific character to which you are accustomed to listen on occasions like this, but I trust the few minutes occupied in reading this paper will not be vain, and that my endeavour to discharge a duty I feel that I owe to the association, by contributing, in however small a degree, anything of a practical character, that may possibly be of service to some one, will meet with your indulgence.

I think it desirable that our papers should be short, and I have not, therefore, gone so minutely into the matter as I might have done, but should any gentleman present wish further particulars, I shall feel a pleasure in giving him any information in my power.

Mr. Cox (Sunderland) asked how many tons of coal carbonized were represented by the £302 profit on sulphate made.

Mr. Eldridge said about 6500 tons.

Mr. Baker said this was a subject in which he took a great interest, for he had been a sulphate of ammonia maker for the last 25 years. He found that from 1476 tons of coal he could produce 10¾ tons of sulphate.

Mr. Eldridge remarked that he had never heard of such a thing before.

Mr. Baker said he had a boiler which held 200 gallons, and he boiled it by steam. The ammoniacal gas came off with the steam very readily in seven hours. This appeared to him to be the only difference between his and Mr. Eldridge's process. He had used his present apparatus about 14 years. He was sorry that he had not taken out the financial details of the manufacture, so as to be able to lay them before the meeting; he could only say that the results were exceedingly good. He recommended every manager who had any difficulty in disposing of his gas liquor to work it up. There was no nuisance whatever in the operation, as the saturating vessel was covered over, and a pipe from it carried off the gas to the boiler.

Mr. Broadhead asked what was the strength of the liquor when Mr. Eldridge commenced to work it up.

Mr. Eldridge said he made his sulphate of about 16-oz. liquor.

Mr. Miles asked whether in a small work, where 1500 tons of coal annually were carbonized, it would be profitable to put up a scrubber, and use it for the purpose of getting a strong ammoniacal liquor.

Mr. Eldridge had no hesitation in saying that it would pay to put up a little apparatus. Mr. Miles said, "Put up a scrubber." He (Mr. Eldridge) took it for granted that there was no gas-work in existence, of any size, without a scrubber. On the previous day there was a remark made about scrubbing too much; for his own part, he would like to scrub much more. He was sure, from experience, that it was profitable in every way to thoroughly scrub the gas, and use the liquor over and over again, so as to get it up to 16-oz. strength. The scrubber very much assisted to remove a large quantity of impurity, which could not otherwise be got out of the gas. He had found that it answered well, in addition to the ordinary scrubbing, to take the liquor as it came from the hydraulic, and work it through the scrubber till it showed 16-oz. strength, and then to use a second scrubber with water.

Mr. Miles said at the works he was speaking about they had no scrubber, but a bell washer, consequently the water was not so strong as it might be. He had been told, in the course of conversation with a gas manager, that the very strongest ammoniacal liquor was not the best for making sulphate.

Mr. Eldridge said he liked to get it as strong as he could.

Mr. Anderson (Bath), from personal experience, believed that more salt could be obtained out of liquor of 5° Twaddle than of 12° Twaddle. The manufacture of sulphate of ammonia was a question which all managers—especially those connected with small works—should go into, because it could be profitably undertaken, and got rid of a nuisance. He manufactured his salts upon the same principle as that detailed in the paper just read.

Mr. Stout (Boston) said he had been engaged in the manufacture of sulphate of ammonia for many years, and he was always glad that he took it up. Before he commenced manufacturing the article the water was either lost, or given away, or destroyed, but he had long since found that it paid well to work it up. His experience taught him that the stronger the liquor the more sulphate he obtained in quantity and the better the quality. The process was a very simple one, and any manager of gas-works could take it up if he chose. He need not go to any great expense for machinery; all he required was a boiler, a saturator, and a drainer, and any one who was desirous to see the process of manufacture, was welcome to inspect his operations. It appeared to him to be a shame ever to allow an article of such value as ammoniacal liquor to be destroyed. His own opinion was that there was a good time coming for sulphate makers, inasmuch as the supplies of Peruvian guano were failing. Gas liquor contained the same fertilizing agent—ammonia—and it was already fetching an excellent price in the market. If he could make twenty times the quantity he had hitherto done he could dispose of it at £19 a ton. He did not make the very whitest salt, because he sold to manure makers, who looked rather for quantity than quality.

Mr. Craven asked Mr. Stout how many tons of coal he carbonized, and the number of tons of sulphate he obtained.

Mr. Baker said the process he adopted was very simple. At present he drained through baskets, but the best way was to drain into a wooden tank lined with lead.

Mr. Church asked whether he used Newcastle coal.

Mr. Baker said the results he had given were those of the last four months, and during that time he had been using some Welsh coal, a little better than he obtained in former years; but generally he used Newcastle coal.

Mr. Craven asked whether he got 11,000 feet of gas out of Newcastle coal.

Mr. Baker said he did with Londonderry coal, No. 4 seam, using high heats, and taking care that the dip was properly regulated, so as not to get undue pressure.

Mr. Stout said his works being now in process of rearrangement, he had not, during the last few months, the opportunity of carrying on the sulphate process so regularly as formerly. During the last entire year his production was rather over 30 tons of sulphate, and the quantity of coal carbonized something short of 5000 tons—say, 4800. He charged his sulphate account with labour and carriage, and indeed every expense that legitimately belonged to it, and, on making up accounts at the end of the year, he found he had made a profit on the manufacture of £250.

Mr. Kelsall said there seemed some misconception respecting the strength of liquor which was preferable for the purpose of making sulphate. A chemical agent recently told him that he preferred 6° Twaddle liquor unscrubbed to 12° Twaddle scrubbed. As to the advantage of scrubbing gas, there could be no question in the minds of those who had had any experience in the matter. If Mr. Myers would go to the expense of erecting a scrubber, he would find that the benefit in the purification of his gas alone would repay the outlay.

Mr. Broadhead said at his works he did not manufacture sulphate, being under contract for five years for all his liquor. In his present contract he was bound to deliver it of 5° Twaddle; formerly it was fixed at 4°, which was about the strength at which it left the hydraulic. By putting it through the scrubber it was brought up to 6° and 6½°, and the purchasers did not mind how high it was raised.

Mr. R. P. Spice said the subject introduced by the paper for discussion branched out into so many topics that it was difficult to compress the remarks he desired to make into any reasonable limit. With regard to the apparent discrepancy in the statements made, he might point out that Mr. Baker appeared to have taken four months experience with a particular kind of coal, and to have estimated the return for the year on that basis, rather than to give an actual result throughout twelve months. Referring to the returns given by Mr. Eldridge and Mr. Stout, it would seem that where operations were carried out for converting the ammoniacal liquor of gas-works into sulphate of ammonia there was a profit of about 1s. for every ton of coal carbonized. It had been said that under some circumstances a return of something like 2s. per ton was attainable. This was a large result, and came very nearly up to what Mr. Baker mentioned. There were a variety of ways of accounting for differences of such an extreme character. He (Mr. Spice) had paid a great deal of attention to the subject of scrubbers, and the result of his experience and observation was that, as a rule, they were either too low or too wide—that the diameter was too great, or the height not great enough. It was necessary that the scrubber should be so constructed as to give a shower of liquor (not water—he abhored water in gas-works, for when used it threw down the hydrocarbons contained in the gas, whereas when liquor was used the illuminating power was not deteriorated, and no offensive results ensued). Every gas manager might with safety bring up the strength of his liquor by passing it through a scrubber designed to suit his works, to 18 ozs. Mr. Stout had now a more powerful scrubber on his works than formerly, and no doubt he would be able to show better results during the next twelve months. With regard to the use of scrubbers generally, a previous speaker asked whether it was worth while to put up one for the sake of making the ammoniacal liquor stronger. He (Mr. Spice) could not understand why any gas-works should be without a scrubber. He did not think much of the use of water in a still, as the particles of gas did not come effectively in contact with the particles of water. He preferred a continuous shower of ammoniacal liquor through a scrubber. The scrubber at Mr. Stout's works was 30 feet high and 10 feet in diameter, and there was a constant stream flowing through. There were five sieves, and the material employed was 9 inches in depth, composed of broken glass and pottery ware. The space between the surface of pottery and the bottom of the next sieve above it was for the gas to tumble about. This he held to be a valuable point, for the gas should have room to twist and turn about, so that every particle of it should come in contact with the liquor, and become thoroughly wetted therewith. It was next to impossible to work a scrubber properly without the aid of steam, or it would become choked with tar, thus increasing the pressure on the retorts and otherwise become objectionable. A small steam apparatus could be put up at a comparatively trifling expense, and be worked without any cost. However small works might be, it was desirable to have a scrubber and a steam-engine, and having these he did not see why there should not be also an exhauster. Step by step he had arrived at the conclusion that the right things to have were clay retorts, exhausters, and scrubbers, and that where the liquor could not be sold it should be converted into sulphate. Gas ought never to be sent out now-a-days, as it sometimes was, charged with ammonia. The ammonia ought to be kept at home and utilized.

Mr. Price said he had followed out a plan very similar to Mr. Eldridge's, and having calculated cost and returns, he found that he realized a profit of cent. per cent. He wished Mr. Eldridge to inform the meeting what means he employed for getting rid of the fumes arising from the manufacture of sulphate of ammonia.

Mr. Stout said he omitted to make one remark which he had intended as an encouragement—viz., that it frequently happened there were other small works to be found in the neighbourhood, the managers of which would be glad to sell their liquor at a low price, so as to make it worth while to undertake this branch of manufacture. With reference to the discrepancy in some of the statements made as to the amount of profit upon the article, a great deal depended upon the way in which the result was arrived at. One manager, perhaps, did not charge labour, fuel, and carriage against the receipts, whereas another probably included every item of outlay, which, of course, was the proper mode of determining the value of the process.

Mr. Greenfield (Torquay) said, from what he gathered in the course of the conversation, Mr. Eldridge worked up to 12 and 16 oz. liquor. Perhaps the gentleman who spoke on the other side had two scrubbers, and passed through the second the liquor which had been through the first. He would be glad to learn whether any of the members had had any experience in sending jets of steam through the apparatus.

Mr. Lane said it appeared to be taken for granted that there were great discrepancies in the results. He could not see that there were any, and he believed the apparent differences arose from the different qualities of coals used. It would seem that Mr. Baker made a little over 6 tons of sulphate per 100 tons of coal carbonized, which was about the same return as that obtained at Boston. The whole difference really amounted only to 10 per cent., which, as he said, might easily be accounted for by the variations in the coals, and probably by a more elaborate system of washing.

Mr. Hodgson Jones rather differed from Mr. Spice as to water not being allowed to come in contact with gas. He was accustomed to scrub gas with liquor through two scrubbers in the manner described, and after that he passed it through a third scrubber, in which water was employed. He found in many towns to which he went that there was ammonia in the gas. Where lime was used for purification there was no fear of taking too much of the ammonia out.

Mr. G. Anderson said he was about the first person to manufacture sulphate of ammonia from gas liquor in London, having commenced it at the Surrey Consumers Gas-Works 18 years ago, when other managers were sending it away in barges. The process which Mr. Eldridge had described was a nice, simple, and easy one, which almost any gas manager could adopt. There was only one very

small objection to it—viz., that, unless there was a water-trap, the products which came from the saturator and ascended the chimney were liable to explosion, and that, in any case, the combustion of those gases in the chimney caused an unpleasant smell, sometimes not so much at the works as at a short distance from the works. There was a mode of getting rid of that objection, which was this: instead of causing the vapours to pass from the close saturator into the chimney, to condense them, as was done in a highly satisfactory manner at the Crystal Palace District Gas-Works. They might all be reduced into a dirty curious liquid, the exact elements of which chemists had not yet defined. A difference of opinion had been expressed as to the proper strength of the liquor—*i.e.*, whether sulphate could be best prepared from a heavy or light liquor. He quite agreed in what had been said as to the value of the liquor to the manufacturer being greater in proportion to the quantity of ammonia it contained per gallon, if the liquor were not too strong; but, from experiments he had made lately, and which had been subsequently confirmed, he was prepared to state that, if sulphate were made from very strong liquor—say, of 20 to 25 oz. (which it might be by washing and scrubbing)—it required from 30 to 40 per cent. more acid per ton of sulphate made than if a weaker liquor were employed. He did not mean to say there was any ammonia lost, inasmuch as a gallon of strong liquor would make more than a gallon of weak. The number of gallons of liquor necessary to make a ton of sulphate would be more with weak liquor than with strong, but the number of pounds of acid to make a ton would be less with the former than with the latter. The explanation of this might be that there were acids in the liquor which assisted in the manufacture—carbonic acid was one—and that with all the washing and scrubbing which might be given to the gas, the proportion of these acids was no more whether the liquor were strong or weak. He was sorry to differ from Mr. Spice, but he was bound to say he was totally at variance with him as to the value of water in washing gas. He could say all that Mr. Spice had said, but he must say it with a circumstance. He could say that the washing of gas with pure water threw down the hydrocarbons, but he must add that this arose from washing with an improper quantity. He had after many years experience arrived at the conclusion, and he was perfectly confident on the point, that nobody should think of saying his gas was purified after simply washing it with ammoniacal liquor. On this point he would speak as strongly as possible. He asserted that when gas had become nearly purified from ammonia, to bring it into contact with a liquid highly charged with ammonia, it was much more likely to take ammonia from the liquid than to yield up any small remaining portions it might previously have contained. The way to purify gas was first to condense it well, having as little use for steam in the scrubber as possible; then to introduce it into the ammoniacal liquor of the works, which he would suppose to be about 5° Twaddle, requiring 10 ozs. of acid per gallon to neutralize it. If this were done the water in the washer would increase in strength so as to require nearly double the quantity of acid to saturate the ammonia. In his practice the gas was passed from the washer through a scrubber supplied with pure water at the rate of 10 gallons per ton of coals carbonized—or, in other words, about double the volume of his ammoniacal liquor. This 10 gallons he could not put on in a constant stream, because such a stream would be very small and would do very little good, as it would trickle down the interstices of the scrubber, finding for itself a passage in the easiest way; while the gas would pass up where there was least resistance, and consequently come but slightly in contact with the water. He therefore supplied the water as a douche by means of a self-acting tumbler, on the principle of a Barker's mill, by which he obtained a very equal distribution of the water, and he found that going in at the top of the scrubber pure it came out at the bottom 5 or 6 oz. liquor. That liquor ran into the ordinary ammoniacal liquor-tank of the works, and was a part of that which, in subsequent operations, was pumped into the washer. On the previous day, it was mentioned that at his old works, at Dover, he did not employ the apparatus described, and that the difference between the gas from the old and new works could be always observed, although the gas was made from the same coal and purified in the same manner. Clearly, therefore, the hydrocarbons were not thrown down by the use of pure water, because at the old works it was not used and at the new works it was.

Mr. GARNETT said in the works under his superintendence, at Ryde, he was placed in such a position that he was not permitted by the local board to manufacture sulphate. But with reference to the value of scrubbers, and the pumping of ammoniacal liquor through them, he might mention that, when he had occasion to stop his pumping apparatus for repairs or otherwise, he found an increase of one-third in the cost of his purification. In answer to Mr. Foulis, he stated that he was obliged, from the circumstances in which his works were conducted, to purify by lime, as there would be a strong objection in the locality to the revivifying of oxide. His purifiers were all on the upper floors, with openings in each floor, and at five o'clock in the morning he had to get carts for miles round sometimes to remove the refuse lime.

Mr. ELDRIDGE, in reply, said a part of the discrepancy between the returns of sulphate spoken of might be accounted for by the fact that last year, in consequence of great difficulty in disposing of tar at his works, he threw away enough liquor to make a couple of tons more than he had shown. This year, during the first five months, he had made 20 tons, so that the results would be more favourable. With reference to Mr. Price's inquiry, he might state that when he first started his apparatus there was sometimes a little offensive smell, and one or two complaints reached him from persons half a mile from the works. No doubt in dense weather there would be a slight smell from the chimney. He had thought that this might be remedied by having a pipe brought from the cover of the saturator into a trough of water with a dip, and a little burner on the top of the pipe to burn off any gases. The suggestion made by Mr. Anderson on this point was valuable, and he was thankful so much information had been elicited during the discussion.

Mr. WARNER read the following paper:—

ON THE BEST FORM OF CARBONIZING ACCOUNTS.

In the consideration of this subject it may be best to look at the *work* itself, of which an ordinary carbonizing diary is but a very imperfect record. The work of a gas company naturally resolves itself into three distinct departments, more or less connected according to the extent of the establishment and administration of its affairs. The three are "Accounts," "Manufacture," and "Distribution." The account, however, as far as the *cost* of keeping them is concerned, is fixed, or only variable from year to year, and therefore need not be further noticed.

We have, then, the indoor and outdoor work to deal with, and these are ever varying with the seasons and districts lighted; hence the necessity of a *constant watchfulness* over the work, that its cost may be kept at a minimum. This watchfulness is not that of an incessant personal attendance at the work—practised in the full belief of the truthfulness of the old proverb, "While the cat's away the mice will play"—but a watchfulness like that of the German general, which will allow the manager to sit comfortably in his office while working out the desired object—the largest possible balance at the end of the half year—and with the full assurance, too, of its being attained. As the *whole* of the work must be watched, and as this must be done constantly, it is necessary to have it epitomized and brought together, that the whole may be seen for comparison, and, if necessary, adjustment or correction; in other words, the COST PRICE *of the whole of the work* under *each separate and distinct class* must be worked out *periodically* and at *short intervals*, and *compared with corresponding previous workings*, and systematically arranged under proper headings showing the *actual* and *comparative cost* of the *labour*, *material used*, and *work done*, and the *cost per* 1000 *feet of gas made*. Copies of forms of account arranged upon this principle, and used at the South Shields works, are placed upon the table for inspection.

There are two sheets, one "The average and comparative cost of gas per 1000, with weekly report of working," and the other is "The average and comparative cost of the distribution of gas per 1000, with report of work." In the first of these we have "Date, number of retorts in action, number of firemen;" and then, under the general heading of "Wages as per wages-book," there are the sub-divisions of "Firemen, coal and coke, engines, purifiers, totals, and cost per 1000 feet made; total wages corresponding week, and cost per 1000." Then follow columns, "Gas made, last year's make, coals and cannel used, yield per ton, cost per 1000; yield last year, and cost; lime and cost, carting and cost, (goods) incidentals and cost;" and then, under two columns, are the wages paid for "Repairs and miscellaneous work," and then the "cost." Following is the "Total cost of distribution per 1000," obtained from the "Distribution sheet." As the total cost per 1000 is what is principally aimed at, all the "cost per 1000" columns are written in red ink, and so are easily cross-cast to arrive at the "Total cost per 1000 feet of gas made, for which the next column is prepared. The remaining columns are "Illuminating power, sulphur in gas, and cost of gas per ton of coals carbonized," for comparison with those who work out the cos upon this principle. The other, or "Distribution sheet," has after the date column a similar wages arrangement as that just described, with columns for "Mains, inspecting, meters, lamplighting, lamp repairs, totals, cost per 1000, and corresponding totals and cost per 1000." Columns for the work then follow. "Meters fixed and disconnected, services laid and relaid;" and under the general heading of "Public lamps" we have the "Number lighted, number reported out by police, number of lanterns repaired, and number of services relaid," and then under another general heading, "Complaints." These are arranged in the order of "Services, meters, escapes, consumers;" following are the "Materials used in each class of work," in separate columns, thus: "Mains, services, meters, public lamps, totals, cost per 1000, and corresponding cost," and then the "Total cost per 1000," and its corresponding column.

In keeping these sheets, all the principal or important items are worked out week by week, and they are also cast at the end of the last week of each month, and the averages obtained, two lines being left under the totals to show the increase and decrease in the averages of the month's working. Thus the work and its cost are arranged for comparison, and by this means a perfect watch is maintained; any increase being at once shown, not only in the general cost, but also in that branch of work in which it takes place, and this can then be immediately compared with the work column to see whether it is proportional, and the result of this extra work well repays the trouble. To some the arrangement may appear too highly elaborated; yet, if properly worked and well kept up, it is not at all troublesome. For instance, after the first year's working, the previous one has only to be copied, and this, to prevent confusion and mistake, is done in blue ink under the same coloured headings, and previous to the commencement of working the sheet. The wages are entered direct, week by week, from the wages book; and the work done and materials used are entered from a sheet containing a weekly abstract from the books in the several departments; the cost per 1000 being worked out in red ink, to prevent mistakes and facilitate the cross-casting by the manager.

For this system it may be said that it has not been theoretically arranged, but that it has gradually assumed its present form item by item, and column by column has been added as the want has been felt. It is now deemed *essential* to the *thorough working* of the concern, from the check it keeps upon the cost and working; each cost being worked out, too, to three places of decimals, the least increase or decrease is at once shown, and the attention immediately drawn to any irregularity of working either indoor or outdoor. Beyond this the manager becomes thoroughly acquainted with the *value* of every item of the work; and so, instead of groping in the dark through each half year, week by week, his work *is managed*, and so he can look forward to the striking of the balance with confidence, knowing that the company has realized full value for its expenditure.

The PRESIDENT stated that Mr. Niven, of Clayton, who was to have read a paper on the same subject, was not present, but he had sent some specimen sheets of his mode of keeping such accounts, which could be examined by the members.

Mr. HODGSON JONES said there was one point in connexion with this subject which was very interesting to gas managers, and that was the method of ascertaining correctly the unaccounted for gas. At a great many works which he visited this was done in a very rough manner. The system he generally adopted was to have a consumers ledger, in which the consumption per meter was taken on each side of the page either monthly or quarterly, and he had found it furnished an extra check upon the state of the meters. The question of meters was often very complicated, and it was difficult to arrive at a just conclusion respecting it.

Mr. R. H. JONES had had some little experience in accounts, and confessed that he was frightened when he looked at the formidable specimen sheets laid before the meeting. He was manager of five or six works, and had weekly returns from each. The totals of these works were summarized quarterly, and the quantities of gas sold in the three months were ascertained; also the quantities of coal used; and thus he got at the consumption and the leakage. He had no comment to make upon the sheets now produced except that they were too formidable, and he should not like to put them into any one's hands except those of a professional accountant.

Mr. BROADHEAD said they had each their own mode of keeping accounts but he had no doubt they all proceeded much upon the same principle.

Mr. WARNER, in reply to Mr. Spice, said the reason why he took the cost per 1000 feet was that, in so doing, there was always something to lay hold on. The cost per ton of coal carbonized was liable to error. He could assure the meeting that there was nothing really complicated in the form of accounts presented, and that they could be practically adopted with great facility and advantage. The principle was to work out every item per 1000 feet made, which gave always a real standard of comparison.

The HONORARY SECRETARY read the following paper:—

ON COAL STOREAGE AND SPONTANEOUS COMBUSTION OF COALS.

By Mr. A. H. WOOD, of Hastings.

The object of the present paper is not to attempt any elaborate description of the chemical transformation that takes place by spontaneous combustion, or to bring before the association matters which can be considered anything more than many of its members are better acquainted with than the writer, but to give a nucleus for the discussion of a subject which is important to every gas manager where from local circumstances the storeage of a winter's supply of coals is absolutely necessary.

There are no doubt many gas-works where the large storeage of coal is not so requisite as others, but there are works, and I presume the majority, where it is absolutely necessary to have a good "nest-egg" of coals for the winter. Such is my own case, and I know of many others who are similarly situated.

I am decidedly of opinion where the continuous supply of coals from the collieries can be safely relied on, that there is a considerable saving in the carbonization; and although I have heard it argued that coal loses nothing by storeage, my experience goes to prove that there is a loss of value, either in yield or illuminating power, varying from 5 per cent. to 10 per cent., or even more, in long-stored coal, over the same coal received in good condition direct from the colliery.

There are, however, certain conditions which no doubt vary the losses which take place in warehoused coals—the original size of the sample of the coals, the grinding of them in warehousing and trimming, the tenderness of the sample,

and, most particularly, the chemical constituents of the coal itself, some coal being much more tenacious than others, and these most probably suffer least. Enough, however, has probably been said in this digression to prove that the storeage of the coal *in good condition* is a subject worth consideration.

One of the most important points, however, in association with the storeage of coal is its liability to spontaneous combustion. Vessels have sometimes been lost with all their crews from this cause alone, and many gas managers have found large stores of coals dangerously heated, while others have gone a step farther and found them actually fired.

It should be the object, therefore, of every gas engineer, where a large store of coal is absolutely necessary, to see that they are carefully stored, and that such precautions are taken as to lessen the danger if not altogether prevent the possibility of spontaneous combustion. With a view to this end, let us just for one moment inquire into the cause of such a calamity, and it follows that if we can discover this we may then with a greater facility prescribe a remedy.

One of the most important causes (if we may not say *the* cause) is the presence of iron pyrities, and their absorption of atmospheric oxygen.

It appears that the white pyrites are more dangerous than the yellow, because they contain a mixture of protosulphuret and bisulphuret of iron, the proportions of which, according to three eminent analysts quoted by Brande, are as follows:—

Protosulphuret of Iron (Fe + S).

	Combining Proportions.	Hatchett.	Berzelius.	Proust.
Iron	1 .. 28	.. 63·5	.. 63	.. 62·5
Sulphur . . .	1 .. 16	.. 36·5	.. 37	.. 37·5
Protosulphuret of iron	1 .. —	.. 100·0	.. 100	.. 100·0

If we look at this analysis for practical purposes, we shall see that about one-third part of this protosulphuret of iron is composed of pure sulphur, the average running out at 37 per cent.

Let us now look at the other ingredient, named bisulphuret of iron; here we find a still more dangerous compound, as its combining proportion is two of sulphur to one of iron (Fe + 2 S), the analysis given of three eminent chemists being as follows:—

	Combining Proportions.	Berzelius.	Hatchett.	Buchold.
Iron	1 .. 28	.. 46·08	.. 46·70	.. 49·00
Sulphur . . .	2 .. 32	.. 53·92	.. 53·30	.. 51 00
Bisulphuret of iron	1 .. 60	.. 100·00	.. 100·00	.. 100·00

The quantity of sulphur in bisulphuret of iron (taking the average of these three chemists) being 52·74, and the evidence of Mr. R. D. Thomson, as quoted by Muspratt, is very similar to his analysis of coal:—

Sulphur	53·35
Pyrites, being iron	45·07
Impurities.	1·58
	100·00

Let us now inquire what takes place when these combinations absorb atmospheric oxygen; in the first place, the oxygen in combining with the sulphur forms sulphurous or sulphuric acid, and in combining with the iron to make oxide of iron, and these combining again to form sulphate of iron, during which combinations chemical heat is evolved to a greater or less degree.

I am indebted to Dr. Letheby for a very lucid, exact, and concise description of these transformations. The doctor says: "The white pyrites of the coal are a mixture of proto and bisulphuret of iron; these undergo oxidation on the access of atmospheric oxygen, and the protosulphide of iron is converted into ferrous sulphate ($Fe\,S\,O^4\,7HO^2$), which is accompanied with sufficient heat, when the action is confined in the mass, to effect the further oxidation of the bisulphide of iron, and thus at last the heat rises to such a pitch as to fire the coal."

There is nothing peculiar in this generation of chemical heat during these transformations, as it is only an ordinary auxiliary in chemical combinations. Almost all oxidation is accompanied by it in some degree, the degree being dependent on the energy with which the combination takes place. Muspratt (vol. i., page 157) gives a very excellent account of the "spontaneous rise of temperature" by the decomposition of iron pyrites used in the manufacture of alum. The same thing also takes place by the use of them for the manufacture of copperas, and a similar action is familiar to every gas manager in the revivifying process of the oxide of iron where used as a purifying material.

Now it is well known that iron and sulphur (the two prominent elements in pyrites) both absorb oxygen with great vigour; in the first place, to form, as before stated, sulphate of iron, and in the second place, sulphurous or sulphuric acid, consequently a great deal of heat is evolved, sometimes (especially when the quantity is large) sufficient to fire the coal, but as in more ordinary cases to considerably raise its temperature.

Now what is the practical inference to be drawn from this? If we know that the master cause of spontaneous combustion is from the presence of pyrites, why allow them to be stored with the coals? why not pick them out as they are being stored? It is not a difficult task, and carters, trimmers, coal wheelers, and stokers are all willing to do their part (for a trifle per bushel), and jealous even of each other as to the quantity procured. I have now done it for some years, and have never found my coal heated since, to say nothing of an unquestionable advantage in the purifying process.

Another important feature in the storing of coal is that it should be stored dry. To say nothing of the inconvenience of having a lot of wet coal come out in the winter to knock down the heats in the retort-house, it is an acknowledged fact that damp or moist coal facilitates the condition of things that I have been discussing—in fact, that moisture in the coal or in the atmosphere to which the coal may be brought in contact tends to increase, if not at first set up, the oxidation of the white pyrites, and consequently chemical and spontaneous combustion. Brande, Muspratt, and Dr. Letheby, and in fact all who have given much attention to the subject, hold this view, and I believe it is the practice, in the manufacture of sulphate of iron from pyrites, to throw them in a heap and moisten them with water to facilitate the very oxidation which every gas manager would seek to prevent.

It follows, then, I think, from this that coal should be stored as dry as possible. I am quite aware that sometimes it is not easy to prevent damp coal being stored, but still something may be done by every manager to lessen, if not altogether prevent, the storing of damp coal.

One means that I have found to assist this end is to keep one warehouse for a more general store than others; in this store I work, both in and out, all the summer. If a sample of coal is not so good or dry as I could wish, it is put here, and used up quickly, only that which is thoroughly satisfactory being stored up for the winter. I am quite aware this cannot always be carried out, but I throw out the hint as being one means of getting a dry stock for the winter where it is practicable; and where it cannot be altogether carried out, it may partially, and even then it may be useful in preventing the coal from heating.

There is one other point I will just allude to—viz., that the warehouses should be so situated that they should not be subjected to any auxiliary heat. I am quite aware that this remark will not apply to factories of any magnitude, but in many small and medium-sized works the coal warehouse sometimes adjoins either the retort-house, a boiler-room, a smith's forge, or something similar, and the auxiliary heat through the wall tends, especially with damp coal, to set up the oxidation. I know one instance where it was unquestionably the case, and I therefore here just throw out the hint.

Having now said sufficient to evoke a discussion, I will, in conclusion, simply repeat that it is my belief, if the pyrites are carefully picked out, the coals stored dry, and auxiliary heat cautiously avoided, we shall not be troubled much with spontaneous combustion in our coal-stores.

Mr. Hodgson Jones regretted that Mr. Wood, in his paper, had not touched upon the question of the ventilation of coal-stores. It was an important matter, as, in his experience, he had known cases of combustion arising entirely from the want of sufficient ventilation. So far was it an admitted fact, that in France the insurance companies would not issue policies to cover stocks of coal, unless due attention had been paid to the proper ventilation of the stores.

Mr. Baker said, having had a coal-store on fire containing 800 tons or more, his attention had been forcibly drawn to the question of how to prevent the recurrence of such a calamity. He had found a very effectual means was to put down a number of empty hogsheads, here and there throughout the store, at the time the coals were laid in. This promoted ventilation, and the men were enabled to go down from time to time, and detect if there was any heat.

Mr. Fraser said, as a coal master and a shipowner, he had had some experience in this matter. Welsh coal was specially liable to spontaneous combustion. On one occasion he had a load of coal lying alongside another ship in a Welsh port. The hatches in the last-named ship were put on night after night, and the consequence was that gas was generated, and the hatches were blown up. In his own ship the hatches were kept open, and a good deal of rain fell upon the coals. The captain took the precaution to use ventilators, consisting of long perforated tubes; but, before the vessel arrived at Alexandria, heat had been set up, and a part of the coal was almost on fire. Scotch coal was little, if at all, liable to spontaneous combustion. He never knew an instance of Fifeshire coal taking fire spontaneously, but after the seams were pretty well worked out, spontaneous combustion frequently took place. At the bottom of many of the pits there was a good deal of iron pyrites; and, though this did little harm of itself, the bed of shale overlying it sometimes fell, and then heat arose, the small coal around evolved gas, and in this way spontaneous combustion was set up. The miners had the first intimation of it from the white damp, which had a most poisonous effect upon them. It did not affect the lights in any way, but had a soporific effect upon the men. In consequence of the possible presence of this white damp, it was found absolutely necessary in some places, after the coal was taken out, to bring to the surface also all the pyrites; then no spontaneous combustion arose. With regard to Scotch coal generally, the only liability was to choke-damp, which put the lights out. He had had 40,000 tons stored for a long time, and it never entered into his head to take any precautions against combustion, and he believed it arose very much from the fact of the small proportion of sulphur in Scotch coal. In order to detect the approach of spontaneous combustion in his coal-stores, Mr. Woodall, at the Phœnix Station, Vauxhall, put iron rods down through different parts of the coals. These rods were occasionally drawn up, and, if they were found to be heated, measures were taken to stop the combustion.

Mr. Hodgson Jones said he used baskets without bottoms to ventilate his coals, and he dropped a thermometer down them every morning to try whether heat was being generated. This was a more convenient means of detection than an iron rod.

Mr. Broadhead asked whether it would not be well to employ 8 or 9 inch pipes perforated with holes, and with good broad bases, and stand them up in various parts of the stores, so as to keep the whole ventilated.

Mr. H. Jones said that plan had been tried, and it was found, in several cases, that these pipes acted as chimneys, and the whole of the coal was burnt if combustion set in. If there were a fire in a store where baskets were used, the coal on the top falling in would choke the flame.

Mr. Ohren wished to say a few words in favour of ventilation. At his works at Sydenham he had twice had the misfortune to have coals on fire. About £150 worth of coal was destroyed, but the loss did not fall upon the company, as the coals were insured, and they received the whole value from the office. For the last three or four years ventilating-shafts in the coal-stores had been used, and it was found by that means that if the coal was at all inclined to fire the gases passed off through the shafts. In fact, the result was perfectly satisfactory. He did not at all understand why, if 9-inch pipes were used as ventilating-shafts, as Mr. Broadhead suggested, the coal should be more liable to fire. Mr. Jones said they would act as chimneys and create a draught, which would increase the liability. In his stores the ventilating-shafts were made 2 feet square, and they were placed 25 feet apart all over the stores.

Mr. H. Jones said he made his remark under the supposition that Mr. Broadhead meant vertical pipes.

Mr. Baker said that if the shafts formed chimneys, there must necessarily be ventilation, because the cold air would come in at the bottom.

After a short adjournment for luncheon,

Mr. Hartley (Westminster) read the following paper:—

ON GAS MEASUREMENT.

The tendency of recent legislation on gas matters appears to lie in the directions of an increase in the illuminating power and of a diminution in the selling price. It follows, therefore, that dividends have now, and will in the future have to be realized upon gas yielding a smaller per centage of profit on its cost than that obtained in days gone by. Gas manufacturers have not been wanting generally in earnestness and industry in seeking to lessen the cost of production, and to a certain extent their efforts have been rewarded; but, judging from experience, and with our present knowledge of the subject, it certainly may be assumed that so long as it continues necessary to produce gas mainly or entirely from coals, its first cost will not be brought materially below the present standard in well-conducted works. It is, therefore, a manifest fact that if, at reduced selling prices and enhanced quality, the full dividends are to be secured, they must be realized by bringing the largest possible proportion of the gas made into charge. Most companies are to a greater or lesser degree sensible of this, and by careful attention to the condition of mains and services, and to the adjustment of the supply pressures during the day and night to the requirements of the consumers, and also by the application of regulators to the public lights, have effected important reductions in the per centage of unaccounted-for gas; but there is yet another part of the distributing apparatus which has not yet received the attention which it deserves—namely, the measures by which the consumption is estimated.

The gas-meter, whether wet or dry, is such an admirable machine, and does its work generally so well, while demanding so little attention, that it seems as though it were sometimes forgotten that the meter is, after all, only a production of mechanical ingenuity, and, like all other machines, requires a certain amount of supervision and correction. Every practical man must be cognizant of the difficulty, nay, the impossibility of producing machines, whatever be their character, which shall be perfectly free from liability to derangement, and it is in the highest degree absurd to expect that the gas-meter should be so pre-eminently perfect as to be exempt from the frailties which are inherent to the offspring of human ingenuity. Yet the author has known of hundreds of cases in past days in which wet meters have been allowed to remain for long periods in use with a deficiency of water in them, and of dry meters being continued in use long after they must have become imperfect, and even in a practical sense worn out. It is true that the limited water range now permitted compels a more frequent and regular attention to wet meters, but still sources of derangement exist; and it is notorious that if a dry meter be continued in action too long uncleaned, it is susceptible of changes which may seriously prejudice the interest of the seller of gas. That such things as these are true in no way militates against the reputation and trustworthiness of the instruments when

rightly regarded. Probably there is no other automatic machine which receives and really requires so little attention, does its work so easily, and, as far as circumstances will permit, so satisfactorily, as the gas-meter. Yet this machine is, unfortunately, a prolific source of discord between the buyer and the seller of gas, and simply, it seems, because too much is expected from it, and because in addition the unscrupulous assertions of agitators and of some unwise meter-makers, have excited the distrust of the public, who have been led to look upon gas-meters as mere "conjuring boxes," which the companies could, at will, cause to indicate large or small (generally large in the public mind) quantities of gas irrespective of consumption, by some mysterious operation of "pressure;" although what pressure means, or in what way it can affect the action of a gas-meter, the public remain in profound ignorance in spite of all the efforts which have been made to enlighten them.

It thus came about that, almost *pari passu* with reductions in the price of gas, and therefore, in an economic sense, the lesser need to the buyer for its exact measurement, the public distrust grew in strength; and this distrust has been but partially allayed by the operation of the Sales of Gas Act, which was passed in the year 1859, and modified by two subsequent Acts. Gas companies and meter-makers generally were quite disposed to welcome any Act of Parliament of a nature calculated to relieve them from unjust suspicion, and at the same time protect the interests and satisfy the minds of the public. Unfortunately, the Sales of Gas Act was, and still remains, a very imperfect measure, in spite of the efforts made at various times by gas companies and meter-makers to obtain such alterations in it as would render it really efficient. It is true that the Act has to a considerable extent served the purpose it was intended to accomplish; but that it has done so is due almost entirely to the intelligence, common sense, and integrity of the inspectors who have had to carry its most important provisions into effect.

The Act is full of imperfections; but its radical defects, in so far as gas interests are concerned, are, firstly, its permissive character — it is only legally operative in any place or district after the magistrates or other duly constituted authority of such place or district have resolved to adopt it. Secondly, its rules for testing meters are so inadequate to the requirements of meter-testing that they render the legal verification of many meters simply impossible by the instruments at the command of meter inspectors; and further, the rules provide for no examination of indexes.

The effect of the permissive character of the Act is, that after an existence of 10 years it is now only legally operative in one county and 52 cities and boroughs in England; so that two important purposes which the Act was intended originally to serve—namely, the compelling of all meters to be stamped, and the establishment of inspectors locally, in order that they might be readily appealed to in case of dispute—are, to a great extent, frustrated. That verified and stamped meters are almost universally employed throughout the kingdom renders the present state of the law scarcely the less objectionable; for, although the stamp on a meter may be referred to, and a certificate of registration produced in any district, yet such evidence will not carry conviction into the minds of consumers so well as would the testimony of a local inspector, who might possibly be a man well known to and respected by those who appealed to him.

Moreover, a system which necessitates many meters to be sent miles away to be tested, and to an inspector unknown to all parties concerned, is little likely to satisfy consumers. The opportunity given to the company, in many instances to have the meter altered and adjusted before it reaches the inspector, must excite the suspicion of consumers; and, although the author is quite aware of the groundlessness for such suspicion, still he knows that it is at times excited, and that the results of official testings have been, in consequence, discredited. Expense, too, is another element which is of some importance when a meter is sent far away. The verification of meter indexes is a matter of vital importance. Under the present system, a meter may be fitted with an index of erroneous construction, or one intended for a meter of another size, and such meter may be verified and stamped without any discovery, by the inspector, of the false registration. Meter-makers, as a matter concerning their reputation, take every imaginable care to avoid errors in respect to indexes; but so they also do, and have done in times past, in respect to the actual measuring capacity of their meters; and, if it be deemed needful to verify meters in respect to *capacity*, in which the *smallest* amount of error is possible, surely it is of much greater importance to verify the *registering* apparatus, in which the *largest* amount of error may be made.

This matter—that is, the making of mistakes—concerns gas companies more than meter-makers. Many gas-fitters undertake the repair of meters, and do them somehow for consumers, and in their hands indexes may be altered erroneously, or wrongly changed, and the discomfort resulting, sooner or later, is certain to fall on the gas company, and the discredit possibly on the maker of the meter. If the index were verified, this source of error would be avoided. The testing of large meters, in a legal manner, is rendered impossible by the rigidity of the rules which have to be observed, and the positive insufficiency of the apparatus which an inspector has to employ, and is able to employ, in many instances. It is enacted by the Act that every meter shall be tested under a pressure of 5-10ths of an inch of water, and when passing the quantity of gas or air per hour which shall be marked on the meter as its measuring capacity per hour. The instruments which the authorities put into the possession of the inspectors, in order to carry the testing rules into effect, are gasholders of $1\frac{1}{10}$, $5\frac{1}{2}$, and 11 cubic feet capacity. Of these sizes the 11 cubic feet gasholder is mostly employed. Now, at the outset, there are practical difficulties in the way of putting connexions of a larger size than 2 inch to an 11 cubic feet gasholder, as there are also in the way of *using* holders with larger connexions. Hence the maximum rate of delivery of air or gas from a holder is soon reached, and it is found that, with one 11 cubic feet holder, it is impossible to deliver gas under 5-10ths pressure fast enough to work any meter above about 80 or 100 light size at full speed; but, even assuming that a 100-light could be so tested, a difficulty arises. A 100-light wet meter should deliver 5 cubic feet of gas per revolution; two revolutions nearly exhaust an 11 cubic feet holder; and much more than such quantity must be passed through fairly to test the meter. Thus with one holder the test must be intermittent, and this method of testing is very likely to lead to error. It is true two holders could be used, and consecutively filled and discharged. This would meet the requirements perhaps of a 100 light, and at the same time give the inspector just as much work to do as one man could accomplish. Much larger meters than the 100-light size are used in most towns, and in order to test such meters according to legal rules, it would be needful for the inspector to be provided, at enormous expense, with many holders and their accompaniments, to have a staff of experienced assistants, and a large establishment to keep the apparatus in. No corporate body would feel or have felt justified in incurring such an expense as would enable an inspector to comply with the legal requirements of extreme or even of mean cases.

But the difficulties do not terminate at the point indicated, for clause 20 of the Act empowers an inspector to enter a consumers premises and therein test the meter, or to have it removed for testing. Many consumers meters are very large, and are fixed in such situations that their removal would be attended with difficulty, expense, and even destruction of property. Such meters must be verified *in situ*, but unless the inspector bring to the place a number of gasholders and fittings at a great cost, he cannot test the meters in a legal manner. Hence it is that inspectors have not hesitated to violate the rules, and to make the best tests in their power, by the use of one gasholder, and at whatever rate of working possible, while the test for leakage under 3 inches pressure has been in most cases entirely neglected. There are hundreds of meters in use which have in this way been illegally verified and stamped. It is now fully time that earnest efforts were made to alter a state of things which will some day cause serious discomfort to many gas companies. It is a field which may yield a prolific crop of distrust in respect to gas companies, meter inspectors, and meter-makers. It may be said, if the rules laid down by Parliament for the consumer's protection be violated in one direction, that in no other direction is the Act to be relied upon, and as a consequence disputed accounts will multiply in number. Consumers may not be inclined to rest satisfied by a statement of the fact that the registration of a meter, especially of a wet meter, may be just as accurately determined at a low rate of working as at full speed.

What is needed is a complete alteration in the system of verifying large meters; the rate of working must be left to the discretion of the inspector, the condition as to pressure abolished, and the testing instrument be a meter instead of a gasholder. The operation will then become easy and accurate, and of course legal, instead of being, as it now is, troublesome, of doubtful accuracy, and illegal. The writer has for years been an advocate for the use of test-meters by inspectors, and, in conjunction with others, sought to render it a legal instrument before the Sales of Gas Act came into operation. He has at last the satisfaction of seeing it included among the standards of the Board of Trade, and rendered a legal secondary standard of cubic measurement by an Order in Council, dated the 24th of March last. The Government authorities are now prepared to verify test-meters, and it only now remains for those who are interested in meter-testing to seek for the removal of all impediments to its use.

The Royal Commission on Weights and Measures made what the author cannot but think to be a great mistake, by including the dry meter among the secondary standards. Certain it is that no inspector who possesses any practical knowledge of meters would think of using a dry meter for testing purposes, even if such meters were likely to stand the process of verification at the Standards Department. The most material reasons against the dry meter, and in favour of the wet, for *testing purposes*, are as follows, and these reasons were submitted by the author to the warden of the standards in July last:—

Dry Meter—Reasons against.—The measuring-chambers are composed partly of flexible material; and measurement is, moreover, dependent on the preservation under all conditions of use, of the absolute soundness of the slide-valves, by which gas or air enters into, and is discharged from the measuring-chambers. The dry meter is subject to disturbing influences, which alter its measuring capacity, and the existence of such disturbing influences could not be known at the time of using the meter, or even before or afterwards. The meter might, under conditions apparently identical, or at all events under conditions in which an inspector could use it, vary to the extent of 2 or 3 per cent., and the inspector know nothing of such variation. No means can be devised which will enable a dry meter to give internal or external evidence of its measuring condition, and therefore it would become necessary, if the dry meter were used for testing purposes, to reverify it at frequent intervals.

Wet Meter—Reasons for.—The measuring-wheel of a wet meter is composed of inflexible material, and is practically incapable of any variation in capacity, except that produced by the elevation or depression of the water level. The measurement is, moreover, independent of any valves whatever. It is free from any influences capable of disturbing its measurement when used under conditions, which the inspector can command and control. It affords internal evidence of its own measuring condition, for the wheel being inflexible and unchangeable as to dimensions, and the depth of its immersion being defined by lines upon water-level gauges, it follows that it is only necessary to charge the meter, on every occasion of using, to the lines on the gauges, to secure optical evidence of the meter's measuring condition; hence retesting at frequent intervals is unnecessary.

The standard test-meters are respectively 20-light and 100-light size. The 20-light model before the meeting shows the construction adopted. The wheels are made of very stout incorrodible metal, and the cases are also lined with the same metal one-eighth of an inch thick; so that the meters are as durable in character as the other Government standards. The standards of cubic measurement now comprise three distinct kinds of instruments—viz., the *cubic foot bottle*, the *test gasholder*, the *test meter*. These instruments differ widely from each other in character and mode of measurement, and the writer believes it will be of interest to consider briefly the conditions under which each may used in order to secure accurate measurement; the dry meter may, however, be passed over, because the reasons already given show that it is not fitted for testing purposes. At all events, the writer has failed to discover any means by which it can be made to satisfy the requirements of meter-testing or of very precise measurement. The cubic foot bottle is merely an outcome of the late Mr. King's "Transferrer." The "Transferrer," in truth, consisted of a cubic foot bottle mounted above an air-chamber, and communicating therewith by means of a syphon-pipe provided with a cock, so that connexion between the bottle and air-vessel could be established or cut off at will. The hypothesis on which this instrument was constructed is, that if the upper vessel or bottle be charged with water, and the water then be discharged into the air-vessel below, a quantity of air exactly equal to the volume of water admitted would be expelled from the outlet of the air-vessel. The suggestion of the bottle form for a cubic foot measure was not lost upon the Astronomer Royal and Professor Miller, and this form was adopted for the standard, with the idea apparently of using it in some such way as Mr. King had devised. Unfortunately, Mr. King's hypothesis was not borne out by the experience of any one who worked with the transferrer. It was found that the volumes of air discharged from the chamber sensibly differed, and that it was impossible to control or even to fully realize the circumstances which induced the variations. In addition to which objection, the labour was considerable, for 62,321 lbs. of water had to be lifted for the purpose of charging the bottle for each cubic foot of air measured, and the operation was altogether slow and tedious. The writer was greatly distressed in his efforts to use the transferrer for the graduation of test gasholders in the year 1861, and after a week's unprofitable labour cast the transferrer aside, and applied the bottle as a direct measurer, in the manner shown in drawing No. 1, being at the time quite unaware that Mr. George Glover had previously devised the direct transferrer, shown in drawing No. 2. The writer ventures to think his method the best. The measurement is nearly automatic, requiring little more than a very moderate increase and reduction in the counterpoise by means of convenient loose weights, in order to discharge and recharge the bottle. On this method the operation of measuring a test gasholder is reduced to the minimum in labour, is exceedingly expeditious, and if the operator be experienced, the results are almost unfailingly accurate.

There is yet another method of using the cubic foot bottle—namely, that employed by the gas examiners of London for testing experimental meters. A bottle illustrative of this method was exhibited at the last meeting by Mr. Sugg, and a drawing of the apparatus appears in the published proceedings. The bottle terminates at each end with a glass tube, the lower marked to indicate the zero, and the upper marked to indicate the terminal point. The bottle is provided at top and bottom with suitable stop and vent cocks, and a pipe connects the lower part of the bottle to a water-cistern, while the upper part of the bottle is put into communication by means of another pipe with the instrument to be verified. Water is admitted at a regular rate through the lower cock, after adjustment to the zero line, so as to give a uniform flow of air from the bottle, and at any desired or possible pressure. The arrangement is, undoubtedly, a very excellent one, and serves its purpose well, but it is attended with various disadvantages—first, the water must be supplied from a cistern above the bottle, and this cistern must either be of somewhat large area or be

placed several feet above the bottle, as otherwise the reduction of head which takes place will affect the rate of discharge to such an extent as to render necessary a constant attention and adjustment of cocks; second, a cubic foot of water is needed for every cubic foot of air measured; hence, either much water must be wasted, or the labour of lifting or the more objectionable process of pumping up from a lower cistern resorted to.

These objectionable and troublesome processes are all avoided in the writer's method of using the bottle as a meter measurer. It is simply to interpose a well-made wet governor between the air outlet of this transferrer (drawing No. 1.) and the meter. No error can or does arise from the intervention of the governor. The latter is weighted to the needful extent, the bottle, governor, and meter are first connected together by pipes and their aëriform contents brought into equilibrium with the atmosphere. The instant the discharge of air from the bottle commences, the governor comes into action, and when the bottle is fully emptied of air, the gasholder of the governor descends and delivers the air which it has received, through the meter, and all once more comes into equilibrium with the atmosphere. This system has been severely tested by the writer, and appears both on the grounds of reasoning and of demonstration to be free from objections, while it certainly possesses strong claims on account of its simplicity, the small amount of trouble it demands, and the continued use of the same volume of water, which last may therefore be readily brought to and maintained at a due temperature. It is to be understood, however, that such direct measurement from the bottle is by no means a necessity in the case of a meter, and can only be readily applied to small meters. The method, moreover, does not give absolute accuracy, for the cubic foot of the bottle is a cubic foot under atmospheric pressure only; but the error is very small, inasmuch as under a mean barometric pressure, and with a meter or other measure opposing a resistance of so much as half an inch water pressure, the reduction in volume would be no more than 1-768th part, or just over ⅓ per cent.

The test gasholder is so well known that it is needless to describe it (there is a model before you), while it would simply be a waste of time to describe that, to you, familiar instrument, a wet meter. Nevertheless, the conditions which affect these instruments, and under which they can be made to measure accurately, may be fairly treated upon.

A gasholder of the usual construction is capable of measuring volumes of gas, while in a state of compression, equal to, exceeding, or in deficit of the atmosphere, these different states of compression being obtainable by the employment of such a number of moveable weights, acting in opposition to the weight of the holder, as will suffice to equipoise it exactly, or to dispose it to rise or to fall with any desired degree of force. As a theoretical proposition, it may be said that a gasholder is an instrument capable of measuring gas independently of pressure or friction, and that friction, in instruments capable of holding and measuring gas, tends generally to the compression of gaseous fluids.

A gas-meter differs widely from a gasholder in its conditions of measurement. In a meter, friction, or resistance, is an essential element. A meter requires power to drive it; this power must be derived from the gas to be measured, so that the gas must be delivered into and pass through the measuring-chambers under some sensible pressure—*i.e.*, in a state of compression greater than that of the atmosphere, and can only be measured while in this greater state of compression. The practical effect of this has been shown to be small; but another important difference in measurement arises from the displacement of water from the measuring-chambers, which displacement increases as the working speed is increased, and renders the meter *slow;* that is, causes it to register *less* than the true volume passed through it. This fact leads to an important proposition—viz., What are the conditions under which a *test* or *standard wet meter* must be employed, in order to secure the closest approximation to true measurement?

If the capacity of the meter has been determined at its normal rate of working, and the water-level defined by marking the gauges when the meter is not working, and when only the atmospheric pressure is acting within it, then the meter must always be charged with water to the indicated level when open to the atmosphere; and it must always be used at its normal rate of working, or, if worked at other rates, the per centage of error due to such rates must be experimentally determined and allowed for. Practically, the error due to varying rates is not likely to exceed about *one per cent.*

If the capacity of the meter be determined at its normal or at any rate of working, and the water-line be defined while the meter is working at the same speed, and the pressure of the inlet gas be acting in the gauges, then the meter can be made to measure correctly at any speed, by the simple process of adjusting the water-line while the meter is working at the rate desired. More water will necessarily be needed in a meter when worked at a high speed, in order to provide for the difference in the levels within and without the wheel.

All large meters, to which gauges are affixed to indicate the water-level, should have the water-line defined while the meter is in motion. The advantages are, that an inspector could test a wet meter at any convenient or possible rate of speed, marking the "working line" while it was in action, disconnect his testing apparatus, set the tested meter in full action, and then add the needful quantity of water to make it measure correctly. Further, an inspection of the water-line when the meter was in full action would at once show whether it was properly charged. The increased accuracy of registration on this system would in many instances possibly amount to 2 per cent. On the usual system the gas must be shut off from the meter before the water-level can be adjusted, causing at times much trouble and inconvenience.

In conclusion, the writer begs to submit the following as the most important points for the consideration of the members of this association:—

1. The advisability of reverifying meters at moderate intervals, with a view to secure the more accurate registration of gas to consumers.

2. The desirability of extending the compulsory application of the Sales of Gas Act to the whole kingdom, so that disputes, &c., may be settled by appeals to local inspectors.

3. The propriety of urging on the Government the necessity of amending the Act, so that its provisions may include the verification of indexes, the use of the test-meter, and free scope for the exercise of the judgment of the inspector in the testing operations.

If it be thought desirable to seek for amendments in the Act, the representations of those interested will now have greater force than heretofore, in consequence of the recommendations made last year by the Standards Commission, which embrace some of the points herein mentioned, as well as others with which gas companies would do well to make themselves acquainted.

Mr. KEARNEY (Clonmel), speaking of the difficulty of ascertaining the true water-line in consumers meters, said he thought it would be well if an external gauge or indicator were employed.

Mr. WARNER said the idea of having an external gauge or indicator had been theoretically but not practically carried out. Some years ago there were several attempts of the kind, and Messrs. Hulett and Paddon had a patent for its use. Another modification of it was by Mr. Smith, who employed a pointer passing through a stuffing-box on the front of the index. There were also several attempts made to put a water-gauge upon the sides of the square front, but the gauge-glasses got broken, and it appeared that at the present time there were no practical means of indicating the water levels. One point touched upon in the paper, which he as a practical man thought worthy the attention of the association, was the importance of the periodical testing of the meters, especially of dry meters. He had tested both kinds at intervals of about five years—*i.e.*, the company's meters; the customers meters he had been rather afraid of touching, because of the expense, but he thought it would have to follow very close upon the other. It certainly ought to be done once in about every five years.

Mr. D. LANE said if it were considered very desirable by gas managers or gas-meter makers to have an external means of determining the water level in meters, the method employed for steam-boilers might be used, and that would get rid of the difficulty about stuffing-boxes, and the danger of gauge-glasses breaking.

Mr. SPICE expressed his extreme gratification at listening to the able paper just read. He wished simply to make a remark on one point, and that was with regard to the objection to dry meters, or rather with reference to the difficulty of keeping them in perfect order. It had fallen to his lot to observe that meters, when applied to public lamps on the average meter system, had on close investigation produced results which were of the most startling character. The meter on one public lamp had recorded as the result of the year's working a consumption of 18,000 cubic feet, while another, which had given apparently the same light, recorded a consumption of only 6000 or 7000 feet, and this had gone into the average. Such varying results, under similar circumstances, created so much discontent in his mind that he obtained the insertion in the Chester Gas Act, four or five years ago, of a clause by which any meter which during a portion of the quarter had ceased to register gas, should be excluded from the calculation altogether in determining the average results—whether such stoppage had been for a night, a week, or a month. The result was that the next meter, which had faithfully performed its duty, governed the 12 or 24 lamps as the case might be. Now it happened that a dry meter would occasionally stand still, and yet when taken down to be tested, the valve being started, it woould be found to be perfectly correct in its measurement. This was a very serious matter for gas companies, and the difficulty was to see how this evil could be remedied. It had been said that if the meter stood still the lights would go out, but that was not always so. He had known instances in which the public lamps were alight, and the meter was standing still, with both the valves partially opened.

Mr. GREENFIELD said he thought the same observation might sometimes be made in reference to wet meters.

Mr. BROADHEAD agreed with the writer that sufficient attention was not paid to the condition of the indexes. He had known cases in which they had worked backwards.

Mr. MILES thought the testing of meters had been too much neglected. He asked for an opinion as to how often 3-light meters should be watered.

Mr. CHURCH felt bound to record his thanks personally to Mr. Hartley for his very valuable paper, and to acknowledge that, in his opinion, Mr. Hartley had been of the greatest possible service to gas engineers. He was a man who had investigated these matters thoroughly, and those who had the pleasure of his intimate acquaintance would be most ready to express their obligations to him. On this occasion Mr. Hartley seemed to have hit the blot, and to have shown most convincingly the defects in the present system of meter-testing. It was to be hoped the matter was now in the hands of individuals who would not be content till they brought it into a more satisfactory state. He was sure all present would agree with him that the existing mode left much to be desired on the part of gas companies. But though gas-meters, whether wet or dry, had their advantages and disadvantages, there could be no doubt they were most useful instruments. Those who had had some experience in meters knew well the difficulties which water companies had had in obtaining a meter which they could trust to, and he believed that up to the present time no reliable measurer of water, under both high and low pressure, had been brought before the public attention. He could recollect the time when gas was supplied to all consumers by contract; and yet with reference to wet meters, how very few improvements had been introduced since they were invented—the reason no doubt being that the principle of them was correct. He had found that wet meters after being in use for some years became slow, arising from the water-level not having been accurately taken. To get the accurate measurement of meters, the water-level must be taken inside the drum. If there was a gauge inside and out, it would be found that, when the drum became dirty or the friction was increased, from a variety of causes, a considerable difference existed in the level between the two; the fact being that there was the water friction inside the drum, *plus* the friction of the drum itself. He thought it would be an excellent plan (though it was a question of expense, which was important) that there should be a periodical inspection of all meters by a competent authority—say, once in five years, which would be quite sufficient. There was one thing which gas managers ought studiously to regard, and that was the necessity of having meters well made. If they went in for cheap meters they must make up their minds to have inaccurate meters. They ought to encourage makers to supply the best possible meters, and to be prepared to pay a fair price for them. He could state from his own experience that indexes were sometimes imperfectly made, and no doubt occasionally they became incorrect; but when the fact was considered of the thousands of meters which were turned out annually, it was marvellous that these errors were so exceptional. It was most desirable that provision be made for testing the indexes, as well as the other parts of meters.

Mr. H. JONES said he had found that the practice was prevalent of fixing meters too small for the consumption, which he regarded as bad policy on the part of gas companies. For his own part, he never allowed anything under a 5-light meter to be fixed.

Mr. PHILLIPS said he used wet meters entirely for public lamps, and did not have the least difficulty with them. In winter they were charged with a certain portion of methylated spirits, and he had never had one stop yet.

Mr. G. ANDERSON said it was clear that they ought not to allow meters to be fixed of a smaller capacity than is due to the number of lights to be used, but the difficulty was that if, say, a 5-light meter were fixed this year, next year the consumer would probably increase his lights to eight or ten. The consequence was that the water-line inside the meter was lowered, and the company did not get full pay for the gas supplied.

Mr. R. H. JONES, with reference to the periodical inspection of consumers meters, said in one of the towns supplied by his firm it was their custom to remove all the meters to the shop every other year, and having rinsed them well out, to put them under the test. In that town they had reduced the unaccounted-for gas from 18 to below 10 per cent., and he believed it was mainly owing to this periodical inspection of the meters.

Mr. G. PARKINSON said he was prepared to admit that Mr. Hartley's paper was exceedingly good, and in the majority of his remarks he entirely agreed, especially with reference to dry meters. It was an excellent idea of Mr. Hartley's to indicate the water-line of wet meters outside the meter—to indicate it at its working capacity; but, unfortunately for the satisfactory working of that plan, the water-line so adjusted was only correct so long as the friction of the meter remained the same as that at which it was adjusted. He (Mr. Parkinson) had had great experience with reference to meters to public lamps. On the first introduction by the Corporation of Birmingham of dry meters for that purpose, they were the cause of great annoyance. Some time back he took down 12 meters—the greater portion of them taken down at the suggestion of the borough surveyor—and out of the 12 there were only five within the limits of the Act. One was 16 per cent. slow, another 23 per cent. slow, another 8, and another 8. The fixing of dry meters in the lamp-columns was a very severe test for them. It had been recently determined by the Corporation of Birmingham to substitute wet for dry meters in the public lamps, and a plan similar to that employed by Mr. Hawksley at Nottingham had been adopted, and so far as it had gone the plan had worked very well—viz., that of fixing the meter in a box below ground. So great was the additional confidence felt both by the corporation and the gas company in wet over dry meters, that it

had been agreed to extend the average principle to one meter in 50 lamps instead of one in every 12.

Mr. HARTLEY said he had to thank the members of the association most sincerely for the kind manner in which they had received his paper, and to assure them that the only end for which he had laboured was to secure that which was *right*. As a meter-maker, he was willing and desirous that the instruments which he supplied should be subject to the severest test, asking only that those who used them should give them a like proportion of the attention which was given to other machines. In respect to a water-gauge, or indicator, Mr. Lane suggested the use of a magnet and a needle. No doubt such an indicator could be applied, but it must be remembered that a meter must be of the character expressed by Mr. Warner in his paper of last year, "as delicate as the finest balance, yet rough as a grindstone." It was subject to all sorts of rough usage in carriage, fixing, and use, and it was, therefore, impossible for it to have any really delicate indicator, as the latter would certainly be liable to injury. With reference to public lamps, he was not prepared to assert whether wet or dry meters were the best, for he knew of cases in which both kinds had exhibited such variations in measurement as had been mentioned. The meters used by Mr. Hawksley had this one somewhat serious disadvantage, that they were very expensive—a disadvantage which was almost fatal to their application in many instances. It must be borne in mind that the quantity of gas recorded as consumed depended on the acting pressure at the burner and the size of the opening. It was true, in almost every case where meters were used for the public lamps, that regulators were also used; but regulators, like meters, were subject to some disarrangement, and wanted looking after. Here might part of the discrepancy in registration be sought, and another part, perhaps, in the unsoundness of the fittings. With regard to indices, he had specially referred to them because he felt that this was a vital point. Once in his experience he got into trouble through a workman putting a wrong index to a meter, and this had induced increased care; but he wanted to be protected from any chance of error. He had frequently found in old meters that the spindle-wheels had been changed by gas-fitters and others, and it generally happened that the maker was discredited. There ought to be some check. Mr. G. Parkinson remarked that the water-line of a meter would vary with an increase of friction. Necessarily so. He (Mr. Parkinson) also remarked that the system suggested in the paper, with a view to secure uniform measurement, failed to indicate the true water-line. But surely it must be evident that, while the meter-wheel was free from corrosion or deposit, if the water-level within it was kept at the same uniform height, the capacity must be uniform.

Mr. G. PARKINSON said theoretically the plan was perfectly correct, but in practice it was incorrect.

Mr. HARTLEY: The errors, if any, are very small.

Mr. G. PARKINSON said unfortunately the errors were very extensive. He went through many experiments some years ago, when Messrs. Crosley and Goldsmith's meter, which was arranged on this plan, came into use, and ascertained the fact that inasmuch as the overflow of water was subject to the inlet pressure, on increasing the friction of the meter, by adding to the number of lights (the measuring capacity being only correct so long as the friction remained the same as when the adjustment was made), the meter varied from 2 to 15 per cent. fast. Another meter made by Mr. Clegg, in which the wheel was made to float, was subject to the same errors.

Mr. HARTLEY said he also had made many experiments with Crosley and Goldsmith's meter, and Mr. Parkinson's observations were perfectly correct in respect to it; but it must be borne in mind that that meter was altogether different from the test-meter exhibited, inasmuch as Crosley's meter had a square front and a compensating apparatus, which, while the meter was at work, continually supplied fresh portions of water to the measuring-chambers, and this, and not friction, caused the meter to vary in its registration. Meters like that exhibited, consisting of a measuring-wheel within a simple cylinder, were not subject to such variations when used in the manner described in the paper.

Mr. G. ANDERSON read the following paper:—

ON FURTHER EXPERIENCE OF TAR PAVEMENT.

In the conversation that arose on Mr. Methven's paper on "Tar Pavement," at our meeting last year, I stated that a considerable quantity of that kind of paving had been laid down at Dover; that we first laid all the paving at the new gas-works there; that we next obtained leave of the corporation to do a portion of one of the public footpaths; that in the following year the corporation took up the matter themselves, employing the men that had done the work for us.

I have now the pleasure to state that the system has been continued up to the present time, and gives universal satisfaction.

Last year we disposed of some 30,000 gallons of tar for this purpose, and, to facilitate the preparation of the material, and render it harder when laid, we have prepared the tar by extracting from it the more volatile compounds, which is much appreciated, and will, no doubt, render the paving more enduring.

As a proof of the public appreciation of this kind of paving, I may state that, on one of the roads leading out of the town, the public had been in the habit of walking on the gravel footpath of one side of the road only; the footpath on the other side of the road was laid with tar paving for a considerable distance; the public crossed over from their former favourite path, and walked on the tar paving as far as it was laid, recrossing to the other side when it finished.

The paving has been done of all breadths, from 1 or 2 feet to 15 and 20 feet wide, and to the length of several miles, as may be judged from the quantity of tar used, as before stated.

Last winter was a very severe one, and well calculated to test its durability. I have since carefully examined the paving wherever I had occasion to walk on it, and I failed to discover a single defect.

The paving is also being employed as garden-paths to houses standing in their own grounds back from the public roads. It is also being used as pavement in the basement stories of houses; and, as one proof of the hold it already has of public opinion, I may state that one of the builders in the town has made it a branch of his profession, and weekly advertises in the Dover newspapers his desire to receive orders for this kind of work.

At the Dover workhouse many of the paths have been paved in this manner, and the master has reported a great saving of shoe-leather of the paupers; and he has advised that the younger children may now have much thinner shoes than formerly, and consequently more suited to their tender years, which will give them a more active gait, and assist in depauperizing them.

We have not been content with merely the footpaths being paved in this manner; we have represented to the town surveyor that the carriage ways should also be tar-paved. We have shown him the paving at our own works, where horses and heavy traffic have been constantly passing over for the last three years, and we have succeeded so far as to try the experiment.

Early in the present year the corporation passed an order for 100 feet in length of the busiest street to be so paved.

The traffic has now been on it some two months, but before it had been a week down the shopkeepers at each end were asking to have it extended opposite their houses, it being so smooth, so clean, and so noiseless.

At the present time a length is being laid down in another street to satisfy, I suppose, the representative in the council of that ward. Of course, for the carriage ways, the *modus operandi* was somewhat different to that employed for the footpaths.

First, there were about 5 to 6 inches of tarred broken granite rolled down; next, the surface was covered with tarred granite chips, and these were rolled in, and the slightest inequality filled in; and, lastly, a coat of smaller tarred chips was rolled in to form the surface.

The town surveyor has several times reported most satisfactorily, and the surveyors from other towns in the country have been sent by their boards to inquire and report upon it.

I have now only to caution gas managers against supposing that all they have to do is to mix tar and stones together and lay them down. We have all made footpaths in this way—perhaps as long almost as there have been gas-works—and with very variable success.

I think the process is described in former transactions of this society; if not, those who wish to try it had better apply to some one who understands it, for success in this, as well as in most other things, depends upon the proper carrying out of details.

I may mention, also, that in several districts of London large quantities of this kind of paving were laid down last autumn. One road in Peckham I have observed, where the footways, about 20 feet wide, are so made. At several railway stations the platforms have been done in the same way, and I think I may say the system is likely to extend.

The sole object of this paper is to spread the information into districts where it may not be so well known, so that gas managers may, as we have done, get a sale for their tar, which very often is a drug and a nuisance, while local authorities are paying double what they need do for paving their streets.

Mr. D. LANE said that some public street pavements of this kind, executed under the superintendence of Mr. Still, at Cork, were, in his judgment, quite as good as the asphalte of Paris, and cost about one-sixth of the price. At first breeze was used with the tar, but was found not to make a sufficiently hard pavement, and ultimately clinkers from the furnace, ground under edge-runners, were employed. If laid down in dry weather, and properly levelled and sloped, nothing could be more satisfactory than this kind of pavement. It did not cost more than 2s. a square yard, whereas no flagging could be laid down in Cork for less than 5s.

Mr. BROADHEAD said in Grimsby 10,000 yards of tar pavement were laid down in 1869, at 1s. 1d. per yard; in 1870, 9000 yards at 1s.; and this year they had a contract for 4000 yards at 1s., making a total of 23,000 yards in the last three years. The corporation was so well satisfied with this pavement that by annual instalments they intended thus to pave all the footways of the town.

Mr. R. H. JONES said the Corporation of Dover were providing funds at the rate of £500 or £600 a year to lay down tar pavement.

Mr. MILES asked whether it was necessary to erect expensive apparatus for distilling the tar; because, if so, it would be a serious drawback in the case of small gas-works.

Mr. ELDRIDGE asked for information as to the *modus operandi* in constructing the pavement, and the general cost per yard.

Mr. G. ANDERSON said he went over a piece of the pavement at Cork, the other day, which had been down for five years, and found it in excellent condition, although the mode of laying it was not so good as was now adopted at Dover. As to apparatus, he might state that in his case it was used because he took the naphtha to some extent out of the tar, but it was not a necessary thing. Two years before, when the tar paving was laid down on the works, this was not done, but they did that which greatly assisted the process of construction—heated the stones. The principle was very much the same as in making clay ballast. The quantity of tar required was just as much as the stones would lick up, and therefore it depended upon the size of the stones.

The reading of papers and discussion was then brought to a close.

ALTERATION OF RULE NO. 7.

Mr. D. LANE said on the previous day a proposition was made to the effect that the past president and acting president be *ex officio* members of the committee. That the question might be brought before the meeting in order, he drew up a resolution which had been submitted to the committee and approved by them. The existing rule was as follows:—"The president, vice-presidents, treasurer, and honorary secretary shall be *ex officio* members of the committee." In place of that he proposed that the rule should read thus—"The president past president, or acting president for the preceding year, vice-presidents, treasurer, trustees, and the honorary secretary shall be *ex officio* members of the committee."

Mr. WARNER seconded the motion, which was put and carried.

PROPOSED AMENDMENT OF BALLOTING PAPER.

Mr. CHURCH said he had a proposition to make, arising out of the desire expressed by many gentlemen to have a voice in determining the place for the following meeting of the association. It was—"That the committee select the names of several towns, the same to be printed in the ballot list, and sent to every member with a request that he would vote for one of the towns mentioned in that list, or substitute the name of any other in lieu thereof, the majority of votes to determine the place of meeting."

Mr. OHREN seconded the motion.

Mr. ALLEN asked whether, if this resolution were adopted, it would be competent to name any other town in the meeting. For his own part, he thought it would be much better to leave the matter to be talked over by the members when they came together.

Mr. CHURCH said the recommendation of this alteration was that it gave the absent members a vote on the question as well as those who were present.

Mr. STOUT said the difficulty would be that if 50 members voted for a certain place, 45 for a second, and 35 for a third, the 50 members would carry their point, although 80 might be said to have voted against them.

Mr. BROADHEAD was quite opposed to the committee selecting half a dozen places, nor did he approve of giving a vote on the question to those who stayed away from the meetings, and contented themselves with reading reports of the proceedings. He was quite willing to abide by the votes of the majority in the meeting.

Mr. WARNER was inclined to think there was much good in the motion, and that it would save a great deal of time being wasted. Still there were objections to it. Something might arise at a meeting which would cause the association to desire to visit a town the following year not mentioned in the circular issued by the committee.

Mr. LANE thought the difficulty might be met by allowing absent members to vote by proxy.

Mr. G. ANDERSON said his opinion was that the association would be acting very unwisely if they increased the power of the committee in the way proposed. They would ultimately arrive at such a condition that the committee would write all the papers, and there would be no need to meet and discuss them. It would be far better, instead of adopting the resolution, to determine the next place of meeting when the members came together.

Mr. CHURCH said it was a question that he personally did not care a rap for. The idea emanated with Mr. Livesey, and, though he thought the speakers were labouring under a misapprehension respecting the motion, he would withdraw it. He was not desirous to give the committee more power than they possessed, and he did not think his motion, if carried, would have that effect.

The motion was withdrawn.

ELECTION OF OFFICERS.

The SCRUTINEERS (Messrs. Longworth and Hutchinson, jun.,) reported the result of their examination of the ballot-papers, which showed that the following gentlemen had been elected as officers, &c., for the ensuing year:—

President, Mr. Jabez Church.
Vice-Presidents, Mr. G. T. Livesey, Mr. J. Wood (Bury), and Mr. T. N. Kirkham.
Treasurer, Mr. H. Newall.
Committee, Mr. J. Somerville, Mr. A. Upward, and Mr. H. Veevers.
Auditors, Mr. S. P. Leather and Mr. A. Hersee.
Hon. Sec., Mr. W. H. Bennett.

NEXT PLACE OF MEETING.

Mr. KELSALL proposed that the next meeting be held in Manchester, which he said was the cradle of the association.

Mr. WARNER proposed Newcastle-on-Tyne, and enumerated many of the attractions offered by that town and the surrounding locality to persons engaged in gas manufacture.

Mr. ALLEN seconded the motion.

Mr. ELDRIDGE said the plan hitherto adopted of meeting alternately in the metropolis had many recommendations, and he proposed that the next meeting be held in London.

Mr. MILES seconded the motion.

Mr. BROADHEAD said Manchester was the first honoured by receiving the association. Let it "rest and be thankful." Out of respect to the memory of their first president, the association ought to visit the town which he represented, and therefore for the seventh time he proposed that the next meeting be held in Leeds.

Mr. G. ANDERSON seconded the motion.

Mr. SPICE said he had been commissioned to present the compliments of the chairman and directors of the Boston Gas Company to the members of the association, and to say that either next year or afterwards they would be glad to show them as much hospitality in that town as it was in their power to offer. He thought it was a refreshing sign of the times that every one wanted to have a visit from them.

Mr. FRASER thought it was a bad plan to go from the custom hitherto adopted of meeting alternately in London.

A show of hands was taken, when there appeared—

For Manchester	17
Newcastle	18
London	30
Leeds	9

The places obtaining the two lowest numbers having been struck out, a second show of hands was taken, when there appeared—

For London	30
Manchester	28

It was thereupon decided to hold the next sittings in London.

TIME OF MEETING.

Mr. PHILLIPS suggested that it would be more convenient if the meetings of the association were held after the adjournment of Parliament.

Mr. FOXALL moved, and Mr. ALLEN seconded—"That the next meeting be held on the first Tuesday in June, 1872."

Mr. COCKEY said it had been suggested that, as the directors of gas companies usually met in the first part of the month, it would be more convenient if the meetings of this association were held in the latter part.

Mr. R. H. JONES moved, and Mr. SMITH seconded—"That the next meeting be held on the second Tuesday in June, 1872."

On a show of hands, there appeared 24 for the second week, and 15 for the first week; the former was, therefore, resolved upon.

VOTES OF THANKS.

Mr. M'NIE proposed, and Mr. OHREN seconded, a vote of thanks to the scrutineers for their services, which was agreed to.

On the motion of Mr. SPICE the thanks of the meeting were presented to the gentlemen who had contributed papers and drawings on the present occasion.

Mr. ANDERSON asked the association to send a deputation to attend the next meeting of the North British Association of Gas Managers.

Mr. ALLEN expressed approval of the suggestion, and thought they might also send their cordial greetings to their brethren in Scotland, through Mr. Whimster, the president of the North British Association, who was now present.

Mr. CHURCH said he thought the invitation should come from the Scottish Association, and that this meeting should not appoint a deputation unasked. They might very well send their compliments, and invite a deputation to attend the next meeting of this association in London.

Mr. FRASER felt it would be desirable that there should exist a bond of friendship between the two societies. The Scottish Association, though smaller in point of numbers, was older in years, and it had been very successful. The members took a great interest in the proceedings of this association, and he was sure if a deputation were appointed to attend their meeting, in July next, it would be most kindly received.

Mr. COX moved—"That the warmest thanks of this meeting be presented to the committee for the able manner in which they have conducted the business of the association in the past year."

Mr. STORER (Stafford) seconded the motion. He said the members of the association were not always unanimous, but he felt sure on this motion the committee would carry all with them, and that the vote would be hearty and unanimous.

The resolution was most cordially adopted.

Mr. GARNETT acknowledged the vote. He said he was quite sure they would all admit that there were times and seasons when duty no less than inclination—on this occasion they ran in parallel lines—required that they should return thanks for the kind support and help they received in the discharge of the obligations they had to fulfil. He need hardly say, because, by the vote just passed the members had expressed their appreciation of the fact, that whenever the committee met they were most anxious to promote, in every possible way, the welfare of the association. There existed amongst them a thorough brotherly feeling, and a determination, by united action, to increase its efficiency and enlarge its influence; and that which gave them confidence and satisfaction in their labours was the kindly reception which they always met at the hands of the members. The bringing together a large number of gentlemen, engaged in one of the most important manufactures of the day, helped to break down many little asperities and to foster friendships for which otherwise there would be no opportunity, and showed that, whether great or small, each had something to contribute to the common stock of knowledge and experience from which all might personally derive profit and delight, to carry back with them for the benefit of those whom, as gas managers, they represented. The committee were happy to be engaged in the necessary arrangements for this purpose, and in their name he desired to thank the members for the cordial way in which their services had been recognized.

On the motion of Mr. R. H. JONES, a vote of thanks was presented to Mr. Newall for his services as treasurer.

The PRESIDENT said he had a proposition to make which required no comment, but would receive at once the cordial assent of the meeting. It was—"That the sincere thanks of the association be presented to the President and Council of the Royal Dublin Society for granting the use of their rooms, and to Dr. Steele, Dr. Reynolds, and other officials, for the courtesy shown by them in the arrangements for the reception of the members."

Mr. CHURCH said as an Englishman he felt great pleasure in seconding the motion, and would only add that he was sure every member of the association would go away with a most excellent impression of Dublin. They owed a vote of thanks to their Irish friends generally, for they had been received most hospitably; and, in carrying the present motion, they would do it not formally, and as a mere compliment, but with the utmost sincerity and satisfaction.

The motion was put, and carried unanimously.

Mr. CHURCH said there was another motion which must not be lost sight of, and that was a hearty vote of thanks to their esteemed friend, the president, on this occasion. Placed in the chair under very disadvantageous circumstances, Mr. White had performed the presidential duties most admirably, and he was well entitled to, as he was certain to receive, the grateful acknowledgments of the members for his services.

The motion was at once and unanimously adopted.

The PRESIDENT: Gentlemen, I cannot but be gratified with the expression of your approbation of my poor endeavours to preside over this meeting. As Mr. Church has truly said, I was called upon quite unexpectedly to occupy this place, and I felt most reluctant to undertake the duty, not being accustomed to the conduct of public meetings of any sort. However, having accepted the office of vice-president, which I did certainly supposing the contingency which has arisen was very remote, I felt that I was bound to accede to the desire of the committee, and take the chair here in the absence of your elected president. I therefore at once accepted the responsibility, and though, in the discharge of my duty, I am conscious of very great defects, I can assure you I have done my best, and I am much obliged to you for the kind manner in which you have received those services.

On the motion of Mr. R. H. JONES, it was resolved—"That the thanks of the association be presented to the directors of the Alliance Gas Company, and to Mr. Somerville, their engineer, for the opportunity afforded the members to visit the works of that company, and for the courtesy and hospitality with which they were received."

Mr. OHREN then moved a vote of thanks to Mr. W. H. Bennett, the honorary secretary of the association, and in doing so said he felt it was needless to say one word respecting the admirable manner in which the duties of his office had been discharged. He would only observe that the association were under great obligations to Mr. Bennett for his services, and he was sure the vote would be cordially responded to.

The PRESIDENT seconded the motion. He said he knew that the honorary secretary had very arduous duties, and that he brought to the performance of those duties an amount of ability and energy which was highly beneficial to the association and satisfactory to the members generally.

The motion was cordially and unanimously adopted.

Mr. HODGSON JONES said the association had now been in existence some years, and its funds were in a flourishing state. He thought, therefore, the present was a fitting opportunity for increasing the remuneration of the honorary secretary to £50 per annum. He moved a resolution to that effect.

Mr. OHREN said he was very glad to second a motion which, if he had not been a member of the committee, he should have been the first to propose.

Mr. WARNER desired to say one word upon the motion. He was sure every one present would feel that the labour which fell to the share of Mr. Bennett, in connexion with the business of the association, was in no way compensated for by the amount which might be voted to him. Apart from other matters, the working out of the details of arrangements for the annual meeting, the correspondence with members and other persons, and the supervision of the printing of the proceedings of the association, required an amount of attention and labour which made the duties of his office very onerous. It was with great pleasure, therefore, that he (Mr. Warner) supported the motion.

The PRESIDENT said he could endorse all that Mr. Warner had stated, and felt sure that the association would not be giving Mr. Bennett a remuneration at all commensurate with his services, even when they had passed, as he was sure they would do unanimously, the motion now before the meeting.

The motion was carried unanimously.

Mr. BENNETT: Mr. President and Gentlemen, I am indeed very much obliged for the extremely kind manner in which you have been pleased to express your approbation of my efforts. I can assure you it affords me great pleasure to be in any way instrumental in promoting such gatherings as the present, and I trust long to see and rejoice in the continued prosperity of the association. With regard to the substantial token you have given of your appreciation, I can only say that the motion just passed was proposed most unexpectedly to me. I am glad to assist the association for the honour and pleasure involved in it; but, as it is your wish to add this further inducement, I bow to your opinion, and thank you sincerely for such a recognition of my services.

The proceedings were then brought to a close.

THE BIRMINGHAM GAS COMPANY.—We regret to state that a most serious investigation into the accounts of the Birmingham Gas Company, Union Street, has been found necessary; and although the result is not yet known, there is no doubt that the company has sustained heavy losses. Yesterday, rumour put the amount at £30,000. We mention this amount only to say that it cannot be relied upon, as the examination of the company's books and accounts is not yet completed, and therefore the directors themselves do not know the extent to which the funds of the concern are affected; but we are informed that "they believe the rumours current to be very greatly exaggerated." Possibly, we are told (though not from an official source), the deficiency may prove to be about £15,000. The manner in which these defalcations have occurred is as yet just as much unexplained as their amount. As to the person responsible there is no doubt. About a fortnight ago, yielding, we believe, to strong representations made to them, the directors, in the temporary absence of Mr. Joseph Harrison, the secretary of the company, ordered a special examination of the books and accounts. The consequence was that Mr. Harrison did not return to the office, but communicated to the directors the fact that he considered it desirable to leave England. As we announced a few days ago, Mr. Slocombe was appoined secretary in place of Mr. Harrison, and the investigation of the books commenced in earnest. Surprise may be expressed that, with any decent system of audit, a considerable deficiency could occur in the accounts of a gas company, the business of which can be readily checked. On turning to the last half-yearly report of the company, however, it will be seen that there was an outstanding balance of debt owing to the company, amounting to £85,000—an unusually large proportion, as compared with the accounts of other companies of the same kind. This balance included the accounts of many large consumers, and with these accounts, we are informed, Mr. Harrison used himself to deal, and thus it was quite possible, by operations extending over a series of years, to receive and apply to personal uses large sums still believed to be outstanding in favour of the company. Supposing the books to be closely kept, and to be tested by a very searching inquiry, at irregular periods, such defalcations ought to have been impossible. No doubt the shareholders will desire and receive ample information upon these points. Indeed, we believe that about two years ago some of the shareholders pressed upon the then board the necessity of changes in the management of the company's accounts; but although compliance with their wishes was promised, the matter was allowed to pass without anything being done. The stability, or even the reasonable prosperity of the company, is not likely to be affected by these defalcations, unless they should prove to have been carried far beyond any amount at present imagined; last half year's business, we understand, was much in excess of that of the corresponding half of 1870; and the balance-sheet presented at the last meeting of shareholders shows a reserved fund of £27,000. Mr. Harrison, we may add, had been for nearly twenty-five years connected with the gas company.—*Birmingham Daily Post.*

Register of New Patents.

2344.—FREDERICK GRAY, of Birmingham, in the co. of Warwick, manufacturer, for "*Improvements in gas-lamps and other lamps.*" Provisional protection only obtained. Dated Aug. 26, 1870.

In carrying out this invention it is proposed, instead of supporting the lamp shade, globe, or glass upon a fixed gallery or framework, to support it upon a collapsible gallery, or a gallery the diameter of which is capable of being diminished. This collapsible gallery is constructed as follows:—To the central tube of the hall-lamp, below the burner, three arms or levers are jointed. These arms or levers are situated in the direction of *radii*, and near to each of their outer or free ends is a vertical peg or stud. The arms or levers are not jointed directly to the tube of the lamp, but to brackets projecting from the tube. On these brackets snugs are made, against which the inner ends of the jointed arms or levers bear. The arms or levers of the gallery are so jointed that, when at liberty to move, they take by their own weight a horizontal position, the arms or levers being prevented from taking a position lower than a horizontal one by means of the snugs described on the brackets, against which the inner ends of the arms or levers bear. The arms or levers are, however, capable of an upward motion, so as to bring their outer ends nearer to one another. The lower opening in the lamp shade, globe, or glass is of a diameter proper to fit outside the pegs or studs, near the outer ends of the arms or levers constituting the gallery, when the latter is in its lowest or normal position.

2354.—THOMAS CLAYTON, of Manchester, in the co. of Lancaster, mechanic, and WILLIAM HENRY BAILEY, of the Albion Works, Salford, in the same co., brassfounder and turret-clock maker, for "*Improvements in apparatus for producing inflammable gas from mineral and other oils, parts of which are applicable for heating purposes.*" Provisional protection only obtained. Dated Aug. 27, 1870.

According to this invention it is proposed that, instead of allowing the gas to be generated in retorts heated in the same manner as the retorts for coal gas, the generators shall be heated by the ignition of the oil gas mixed with atmospheric air, the mixture being obtained by any well-known description of blowing apparatus. To obtain the greatest effect from the heat, improved heating surfaces are obtained by fixing on the generator one or more truncated, sugar-loafed, or other shaped cones, either plain, corrugated, or formed with serpentine indentations, each cone being surrounded with another cone, of a similar shape, in the interior of the generator, there being a space between the two and the heat from the ignited gas and air is impinged on the surface of the smaller cone. Flat or annular corrugated metal may be used for heating surfaces.

2361.—EDMUND CHIVERTON, Orient Cottage, Middle Street, Southsea, in the co. of Hampshire, for "*Improved means of and apparatus for lighting gas-lamps.*" Patent dated Aug. 29, 1870.

This invention consists of an external vessel or chamber having three tubes within it. The vessel can either be inside or outside of a lamp connected to street or other connexions, which communicates to or from the principal gas-mains in the street, and from which it receives a continuous supply; an inlet communication is formed from the main supply to the first vessel or chamber, also an inlet is formed from the first vessel or chamber to the first tube, also from the first to the second tube, wherein is deposited a chemical (glycerine is proposed), at the bottom of the tube, and a mixed liquid or water above, and in this tube the first action takes place, and as the pressure is increased at the gas-works, gives pressure on the liquid causing the liquid to rise in the third tube, which acts on a double floating valve, the valve being raised by the pressure of the liquid allows the gas to emit itself from the valve-box, passing out at the burner, which is supplied from the inlet of the first vessel, a gauge-line is thereby formed by the liquid, which acts as an indicator for regulating or setting the apparatus for any fixed pressure that may be required. By this method the first pressure put on at the works gives an instantaneous illumination to all lamps wherever the apparatus is fixed. When the pressure is taken off at gas-works back to its daily pressure, it extinguishes the night illuminator by the valve closing, bringing the apparatus back to its setting form; the valve closing on one side opens a small passage to allow a very small light to be burning during the day, which is also supplied from the first tube; this light is not visible. There is never more than one light burning at a time, consequently none of the illuminating power is destroyed as it would be by having two lights situated close to each other.

2377.—THOMAS ATKINS, of St. Albans, in the co. of Herts, for "*Improvements in apparatus for economizing the waste heat and gases from furnaces, and in means for generating, collecting, and purifying gases, such gases being applicable to various useful purposes.*" Patent dated Aug. 31, 1870.

The first part of this invention relates to the utilization of the gases and waste heat escaping from steam-boiler and other furnaces. For this purpose a stationary or rotary screen is arranged, composed of a series of pipes perforated with fine holes and surrounded by wire gauze, fire-brick, pumice-stone, or other suitable materials for screening and filtering such gases as they escape into the flue, an injector being employed to force the hot gases into a boiler or steam generator for economizing and utilizing the otherwise waste heat.

The steam and vapour of a steam-boiler charged with gases, as previously described, may be employed for actuating steam-engines, or for increasing combustion in furnaces of every description, by introducing it in the form of jets or spray.

In generating gases in accordance with this invention, a stove or cylinder of any desired form is constructed, and a moveable grate fixed in the same, and air admitted through a suitable valve or opening to the materials employed for combustion for generating gases. The said materials are composed of different proportions of mineral, vegetable, and animal charcoal combined with coke or anthracite coal. By the combustion of these materials in the said stove carbonic acid and nitrogenic gases are generated of various specific gravities in the proportion of the different mixtures used therein, as described in the specification of a patent granted to the inventor, bearing date the 4th day of March, 1870, No. 642, such gases according to the invention therein described being employed for extinguishing fire or for warming buildings, and to the use of such gases for those purposes no claim is made in present patent, the said gases being extracted by a steam-jet or injector, or by vacuum or pressure, by a pump, or by a vessel filled with water, such water as it is discharged forming a partial vacuum.

For purifying or filtering the gases generated as before described, either a stationary or rotary screen is employed composed of a series of pipes perforated with fine holes, and surrounded by wire gauze, fire-brick, or pumice-stone of any degree of fineness, and a steam-jet is used for cleansing the said screen when required.

The gases may be washed in pure water or in water containing lime in solution, or a proportion of oxide of iron, for their purification. For storing such gases a force-pump is employed to force the gases into vessels at suitable pressures ready for use. The said gases are applied by introducing them into any vessel employed for storing and preserving food, milk, beer, syrups, or other liquids, the gases being introduced into such vessels either by their specific gravity or by any required pressure, or they may be connected with a pump, and may be forced into a boiler or vessel containing fluids, by which action the purification and preservation is effected of such fluids, food, or materials, or for refining and purifying sugar. By changing the various proportions of the said fuel, gases are obtained of various admixtures and densities as may be found most suitable in practice for purifying water, and whereby the incrustation of steam-boilers may be prevented. For cooling the gases they are passed through pipes, such pipes being surrounded with other pipes for securing a running stream of water containing ice or iced water; or the outside tubes may be surrounded with cloth or other material kept damp for evaporation. Such pipes may be connected with a cistern, and the water used may be employed to purify the gases as before mentioned.

By the combination of the materials used to produce the gases and the apparatus for generating and purifying the same, gases are obtained of different mixtures and specific gravities, and at such temperatures as may be required.

2383.—ISHAM BAGGS, of High Holborn, in the co. of Middlesex, scientific chemist and engineer, for "*Improvements in steam and gas engines.*" Provisional protection only obtained. Dated Sept. 1, 1870.

These improvements consist in applying the power of steam or gas directly or indirectly to a screw or screws, or to a curved inclined surface or surfaces of any description to produce circular motion. The main or other shaft of the engine is furnished with a screw upon its periphery, and a roller or inclined surface actuated by the steam or gas presses upon the head of the screw and causes its revolution. A right and left handed screw are placed on the same axis, to produce a continued uniformity of motion from a reciprocating force, or the shaft may be worked by a single screw through the medium of two inclined planes or surfaces placed on opposite sides of the shaft and alternately pressing or rolling thereon through the medium of suitable machinery.

2384.—CHARLES HENRY CHADBURN and WILLIAM CHADBURN, of the firm of Chadburn and Son, of Liverpool, in the co. of Lancaster, opticians and philosophical instrument makers, for "*Improvements in mechanical telegraphs and liquid to be used therewith, which fluid is also applicable as a power transmitter; for other purposes for the making of liquid joints, and other purposes where it is desirable to use a liquid that does not readily congeal or evaporate.*" Patent dated Sept. 1, 1870.

An apparatus constructed according to this invention may consist of (say) two small cylinders fitted with covers, stuffing-box, glands, ports, pistons, and piston-rods, resembling an ordinary steam-engine on a small scale, except that they are without valves or valve-gear. When two cylinders only are used, one is placed where the orders or signals are to be issued from, and the other where they are to be received. The ports of the cylinders are connected together by a small pipe fully charged with any suitable liquid, but, by preference, with a fluid consisting of glycerine, or glycerine in combination with (say) one-third of water, which the inventors have found by actual experiment does not evaporate when exposed to a high temperature, nor does it freeze when exposed to a temperature many degrees below zero. The fluid is used as a means of communicating the power applied to the piston-rod of one cylinder to that of the other, the cylinders being connected together by a pipe opening into the interiors thereof above the pistons, and by a second pipe forming a passage between the cylinders below the pistons, by which arrangement the pistons operate and travel in opposite directions.

2398.—JOHN WARD GIRDLESTONE, of 37, Norfolk Street, Strand, in the co. of Middlesex, for "*Improvements in 'dry' closets, commodes, urinals, and other receptacles for putrescible matter.*" Patent dated Sept. 2, 1870.

This invention relates to those closets in which the earth is delivered by the reservoir, and consists, first, in supporting the latter upon trunnions situated at the front of its sides; and, second, in combining with the reservoir a tray and hopper.

2411.—GEORGE HASELTINE, of Southampton Buildings, London, for "*An improved recording pressure-gauge and alarm apparatus.*" A communication. Patent dated Sept. 3, 1870.

This invention consists, first, in the use of elastic circular diaphragm springs or chambers, united by hollow coupling connexions at their centres, and arranged in a series of one or more pairs; second, in the combination of springs or connecting-rods, and an oscillating segmental rack, with the pinions, shaft, spur-wheels, and racks, by which the range of motion is multiplied, and power obtained to rotate the paper-carrying drums, and to sound an alarm; third, in the combination of a chart arranged upon drums, with mechanism for operating so as automatically to record the increase and decrease of pressure by diagonal, vertical, or continuous lines.

2416.—WILLIAM WALKER, of the city of Manchester, engineer, for "*Improvements in propellers, pumps, and blowers.*" Provisional protection only obtained. Dated Sept. 6, 1870.

These improvements consist in employing one or more blades, of a peculiar form and rapidly increasing pitch, affixed to a shaft or spindle by means of a hollow boss, of a sperical, spheroidal, or other similar shape, and surrounding the whole with a hollow case of similar or corresponding shape, either attached to the outer edges of the blades so as to revolve with them, or such hollow case may be fixed independently so as not to revolve, which in the case of a ship or boat must be to the vessel itself.

2418.—ANDREW M'NIEL, of Tiverton, in the co. of Devon, engineer, and WILLIAM WHEATON, of Exeter, in the same co., merchant, for "*Improvements in the manufacture of salts of ammonia from ammoniacal gas liquor.*" Provisional protection only obtained. Dated Sept. 6, 1870.

This invention consists in adding to the gas liquor, when treated by any of the known processes for disengaging the ammonia therefrom, animal matters, such as bones, blood, or other animal offal. When the ammonia is disengaged by the chemical agents a considerable portion will be taken up by the animal matters, and these latter will be dissolved in the process, and reduced to such a state that they may be converted into manure by any of the ordinary processes, or the ammonia may be extracted and used for other purposes in the arts.

2422.—THOMAS MURRAY GLADSTONE, of York Buildings, in the city of Westminster, mechanical engineer, for "*Improvements in chimney-tops and ventilators.*" Provisional protection only obtained. Dated Sept. 6, 1870.

According to this invention it is proposed to employ, above the top of the chimney or other flue, a wheel so constructed as to be set in motion by the wind in order to aid the draught thereof. On the axis of this wheel, and contained within the chimney or flue, is mounted a screw or fan like that of a smoke-jack, which when driven by the wheel above, pumps up the air in the chimney.

2426.—CORNELIUS WILLIAM MORLEY, of 42, Clifton Road East, St. John's Wood Road, London, for "*Improvements in gas-burners, and in the construction of the same.*" Patent dated Sept. 7, 1870.

These improvements consist in the inlet and chambers being constructed to deliver a wide volume of heated gas to the orifice or orifices where ignition takes place at a low pressure, and in so arranging the position and shape of the inlet and interior of the burner that the gas may glide therein, and its pressure to the outlet or orifices may be increased, or by another method regulated and completely shut off while burning, without altering the position of the flame. This is chiefly effected by a cavity being tapered to a small hole or inlet, which gradually widens to another cavity or tube leading to a chamber from which the gas passes through a quantity of holes placed in a cross direction to the inlet into the second chamber, and thence through a piece of gauze of a convex shape into a third chamber of a minimum width of 7-16ths of an inch at its narrowest part, where the outlet is fitted. The supply to the outlet may be increased by enlarging the inlet with a broach or other tool. By another method it is opened or closed by a ball covered with leather or other soft material, and attached to a rack which moves in the tube by a pinion wire inserted transversely through the side of the burner, and turns with a key which projects from the burner, and may be fixed or removed. This key points on an index marked at the side of the burner for any pressure.

APPLICATIONS FOR LETTERS PATENT.

1713.—WILLIAM ROBERT LAKE, of the firm of Haseltine, Lake, and Co., Southampton Buildings, London, patent agents, for "*Improvements in mechanism for operating the valves of water-meters.*" A communication. July 1, 1871.

1716.—PHILIP JOHN DAVIES, of 7, Campsbourne Terrace, Hornsey, in the co. of Middlesex, hydraulic engineer, for "*An improved apparatus for the prevention of damage caused by the bursting of water-pipes in times of frost or otherwise, and for the prevention of water waste generally.*" July 3, 1871.

1724.—ELOY NICOLAS SCHMITZ, of 23, Boulevard de Strasbourg, Paris, engineer, for "*Improvements in gas-engines.*" July 3, 1871.

1735.—WILLIAM THOMAS WALKER, of the firm of C. and W. Walker, of the Midland Iron-Works, Donnington, near Newport, Shropshire, and 8, Finsbury Circus, London, for "*Improvements in apparatus used in gas-works for cleansing and purifying gas from ammonia and other impurities.*" (Complete specification.) July 4, 1871.

1741.—ALFRED SAVAGE DIXON, of Leeds, in the co. of York, brassfounder, for "*An improved water-gauge or other gauge-cock.*" July 4, 1871.

1743.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in the construction of roads, street-pavements, side walks, floors, and other analogous surfaces.*" A communication. July 4, 1871.

1745.—JESSE HILDRED, of Batley, in the co. of York, borough surveyor, for "*Improvements in apparatus for ventilating and trapping sewers, and for affording access thereto.*" July 4, 1871.

1749.—MATTHEW WILSON, of Hill's Place, Oxford Street, in the co. of Middlesex, wine merchant, for "*Improvements in sink-traps.*" July 5, 1871.

1754.—JOHN BAKER, of St. Mary's Road, Southampton, in the co. of Hants, for "*Improvements applicable to water-closets for deodorizing and counteracting the noxious effluvia emitted therefrom.*" July 5, 1871.

1783.—ALBERT TIBBITTS, of 41, Lansdowne Crescent, Notting Hill, in the co. of Middlesex, gentleman, and EDWARD FULLWOOD, of 8, Newton Terrace, Lee, in the co. of Kent, cement manufacturer, for "*Improvements in paving streets and paving or covering other surfaces.*" July 7, 1871.

1795.—ROBERT SKINNER, of the city and co. of San Francisco, U.S.A., for "*Improvements in the manufacture of artificial stone for pavements, roadways, submarine walls, sewers, pipes, and other similar constructions.*" July 8, 1871.

1797.—THOMAS WHITWELL, of the Thornaby Iron-Works, Stockton-upon-Tees, in the co. of Durham, for "*Improvements in valves.*" July 8, 1871.

1804.—WILLIAM HOLLINSHEAD, of Peckham, in the co. of Surrey, for "*Improvements in the method of and apparatus for lighting railway carriages with gas.*" July 11, 1871.

1813.—FRANCIS SEWELL COLE, of Thorncliff, Freemantle, Southampton, in the co. of Hants, gentleman, for "*A new or improved reversible hydraulic machine for raising water and other purposes.*" July 12, 1871.

1829.—JOHN JOSEPH FRANKS, of Stroud, in the co. of Gloucester, civil engineer, for "*Improvements in the mode of flushing as applied to lavatories, urinals, and water-closets.*" July 12, 1871.

GRANTS OF PROVISIONAL PROTECTION.

1555.—JOHN FLEMING ALLAN and JAMES MOFFAT, both of Glasgow, in the co. of Lanark, N.B., gas engineers, for "*Improvements in gasholders.*" June 12, 1871.

1565.—ANTHONY KENT, of Twickenham, in the co. of Middlesex, clerk, for "*Improvements in apparatus for charging and discharging gas-retorts, and for other similar purposes.*" June 13, 1871.

1641.—EDWARD THOMAS HUGHES, of the firm of Hughes and Son, of 123, Chancery Lane, London, patent agents, for "*An improved valve for stopping and regulating the supply of water, steam, gas, air, and other similar purposes.*" A communication. June 22, 1871.

1671.—WILLIAM BURNS, of Little Ilford, in the co. of Essex, for "*Improvements in pipe-joints.*" June 26, 1871.

1716.—PHILIP JOHN DAVIES, of 7, Campsbourne Terrace, Hornsey, in the co. of Middlesex, hydraulic engineer, for "*An improved apparatus for the prevention of damage caused by the bursting of water-pipes in times of frost or otherwise, and for the prevention of water waste generally.*" July 3, 1871.

1724.—ELOY NICOLAS SCHMITZ, of 23, Boulevard de Strasbourg, Paris, engineer, for "*Improvements in gas-engines.*" July 3, 1871.

1754.—JOHN BAKER, of St. Mary's Road, Southampton, in the co. of Hants, for "*Improvements applicable to water-closets for deodorizing and counteracting the noxious effluvia emitted therefrom.*" July 5, 1871.

NOTICES TO PROCEED.

474.—ROBERT HEYWORTH, of the city of Manchester, plumber and sanitary engineer, for "*Improvements in apparatus for supplying water to wash-basins, and for flushing water-closets and urinals.*" Feb. 23, 1871.

531.—ALGERNON GUTHRIE and JAMES STEVENSON, of Gravesend, in the co. of Kent, for "*Improvements in motive-power engines, pumps, and meters.*" Feb. 27, 1871.

556.—JAMES BANNEHR, of Great Queen Street, in the city of Westminster, and HENRY MATTHEWS, of Gower Street, in the co. of Middlesex, for "*Improvements in treating coal for the manufacture of gas and fuel therefrom.*" March 2, 1871.

572.—CHARLES FORSTER COTTERILL, of Cannock, in the co. of Stafford, gentleman, and GEORGE BIDDLE, of Cannock aforesaid, plumber, for "*Improvements in attaching taps or stop-cocks to water, gas, steam, and other pipes, for making connexions therewith, and in apparatus to be employed for that purpose.*" March 3, 1871.

576.—JOHN DUNKLEY, of Adelaide Villas, Park Road, Teddington, in the co. of Middlesex, builder, for "*Improvements in sewers and the treatment and distribution of sewage manure.*" March 3, 1871.

648.—GEORGE DOMINICUS KITTOE and PETER BROTHERHOOD, both of 56, Compton Street, Clerkenwell, in the co. of Middlesex, engineers, for "*Improvements in apparatus for steering vessels, parts of which are applicable to valves for regulating the flow of liquids.*" March 11, 1871.

714.—JOSEPH SALTER OLVER, of Victoria Road, Kentish Town, London, civil engineer, for "*Improvements in urinals and lavatories, and for regulating the supply and discharge of water and other liquids to and from the same.*" March 17, 1871.

1049.—WILLIAM WILLIAMS BOX, of Crayford, in the co. of Kent, for "*Improvements in apparatus used in the manufacture of gas.*" April 21, 1871.

1417.—ALFRED ATKINSON POLLOCK and JULIUS FREDERICK MOORE POLLOCK, both of Leeds, in the co. of York, for "*Improvements in dry closets and commodes.*" May 26, 1871.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2059.—ANDREW THOMSON, "*Improvements in water-closets.*" June 26, 1868.

2067.—ISHAM BAGGS and FREDERICK BRADY, "*Improvements in the extrication and condensation of ammonia, and in the manufacture of ammoniacal salts.*" June 27, 1868.

2079.—SAMUEL HANNAH, "*Certain improvements in fluid-meters.*" June 29, 1868.

2084.—ALFRED VINCENT NEWTON, "*Improvements in liquid-meters.*" June 29, 1868.

2103.—WILLIAM BROOKES, "*Improvements in meters for measuring water and other liquids.*" July 1, 1868.

2159.—THOMAS JEFFERSON MAYALL, "*Improvements in the manufacture of gas-tubing and other articles of india-rubber.*" July 8, 1868.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

1599.—BENJAMIN FRANKLIN STEVENS, "*Improvements in the application of petroleum, coal oil, and other similar substances to the purposes of heating, lighting, and obtaining motive power, and in the apparatus employed therein.*" June 25, 1864.

1616.—THOMAS THOMSON and JOHN MURRAY, "*Improvements in means or apparatus for supplying water to water-closets and other places in regulated quantities, which improvements are also applicable to measuring the flow or passage of fluids, and part of which improvements is also applicable in the construction of cocks or taps.*" June 28, 1864.

PROLONGATION OF PATENT.

1713.—THOMAS SPENCER, of 32, Euston Square, in the co. of Middlesex, analytical chemist, for "*Certain improvements in the purification of water and other fluid and gaseous bodies.*" June 19, 1871.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£		£ s. d.	£ s. d.	£
8000	20	Anglo-Romano	20 0 0	10 0 0	22 — 23
5000	20	Bahia (Limited)	20 0 0	3 0 0	13½— 14
1008	20	Do., preference	20 0 0	10 0 0	24 — 26
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	6 15 0	6½— 6⅞
10000	5	Do., third issue	4 0 0	6 15 0	1¼—1½ pm.
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge., and Holywell.)	20 0 0	10 0 0	34 — 35
7500	20	Cagliari (Limited)	20 0 0	7 0 0	19½— 20½
112000	10	*Chartered*	10 0 0	8 0 0	15 — 16
10000	10	Do., B shares, 4 per cent. max.	10 0 0	4 0 0	6¾— 7¼
25000	10	Do., 5 per cent. preference	10 0 0	5 0 0	12¾— 13¼
20000	10	Do., 5 per cent. preference, second issue	8 0 0	5 0 0	2¾—2¾pm.
20000	10	Do., 10 per cent. preference	10 0 0	10 0 0	19 — 20
17490	25	*Commercial*	25 0 0	10 0 0	43 — 45
20000	20	Continental Union	20 0 0	8 0 0	25 — 27
10000	20	Do., new	7 10 0	8 0 0	2¾—3¼ pm.
5213	20	Do., preference (France: Strasbg., Cette, Nismes, Montargis, Vienne, Roanne, Beaucaire, Rueil, Albi. Italy: Milan, Genoa, Parma, Modena, Alessandria, Messina.)	20 0 0	7 0 0	25 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16½— 16⅞
5000	10	Do., preference	10 0 0	6 0 0	11 — 12
6044	10	Do., new shares	10 0 0	7 0 0	12 — 13
3956	10	Do.	1 0 0	7 0 0	1¼—1½ pm.
23406	10	European (Limited)	10 0 0	11 0 0	16 — 16½
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	3¼—3½pm.
5000	10	Hong Kong (Limited)	10 0 0	10 0 0	13½— 14½
1560000	50	*Imperial*	100 0 0	10 0 0	176 —178
26000	12½	Do., new shares	12 10 0	7 0 0	16 — 16½
25000	12½	Do., new shares, 1870	5 0 0	7 0 0	2¾—3¼ pm.
1300	100	Do., bonds	£100	10 0 0	190 —195
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	9 2 6	65 — 67
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	68 — 70
3000	10	Do.	10 0 0	5 0 0	8 — 9
3000	20	Do.	17 0 0	7 10 0	4 —5 pm.
250000	Sk.	*London*	100 0 0	10 0 0	174 —177
24000	Sk.	Do., 1st preference	100 0 0	6 0 0	119 —121
	Sk.	Do., 2nd preference	100 0 0	6 0 0	
	Sk.	Do., 3rd preference	100 0 0	6 0 0	
£18781	100	Do., 1st preference stock	100 0 0	6 0 0	119 —121
£11828	100	Do., 2nd preference stock	100 0 0	5 0 0	103 —105
15000	5	Nictheroy, Brazil (Limited)	5 0 0	5 0 0	3¾— 4¼
6000	5	Malta and Mediterranean (Limited)	5 0 0	7 0 0	5 — 5½
20000	5	Do., preference	2 0 0	5 0 0	2¼ — 2⅝
30000	5	Mauritius (Limited)	5 0 0	10 0 0	7⅜— 8¼
30000	8	Oriental (Calcutta)	2 10 0	10 0 0	1¼—1⅞ pm.
10000	5	Do., new shares	5 0 0	nil.	2⅛— 2⅜
14000	10	Ottoman (Limited)	10 0 0	8 0 0	10½— 11⅛
27000	20	Pará (Limited)	20 0 0	10 0 0	35½— 36½
3600	100	*Phœnix*	40 0 0	7 10 0	53 — 55
144000	Sk.	Do., new	100 0 0	5 0 0	89 — 91
5000	20	Do.	20 0 0	10 0 0	33 — 35
	20	*Ratcliff*	20 0 0	10 0 0	32⅞— 33¼
6959	5	Rio de Janeiro (Limited)	5 0 0	6 0 0	
2000	5	Singapore (Limited)	5 0 0	7 10 0	
1500	32½	Do., preference	32 10 0	12 0 0	
4000	50	Shanghai	50 0 0	10 0 0	88 — 90
4000	12½	*South Metropolitan*	12 10 0	10 0 0	21 — 22
20000	12½	Do.	2 10 0	10 0 0	5⅛—5⅞ pm.
15000	10	Do., new shares	10 0 0	10 0 0	16⅞— 17½
10000	10	*Surrey Consumers*	6 0 0	10 0 0	4¼—5½pm.
9000	4	Do., new	4 0 0	5 0 0	3— 3¼
1500	10	United General (Limerick)	10 0 0	10 0 0	13 — 14
1500	10	*Wandsworth and Putney*	10 0 0	7 10 0	7¼— 8
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	18 — 19
10000	10	Do., B shares	9 0 0	10 0 0	7⅞—8 pm.
10000	10	Do., C shares	9 0 0	10 0 0	7⅞—8 pm.
20000	10	Do., D shares	1 0 0	10 0 0	3—3½ pm.
12000	5	*West Ham*	5 0 0	8 0 0	6¼— 6⅝
10000	5	Do., new shares	1 0 0	8 0 0	1¼— 1⅜
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1 in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 15 0	2 17 6	2 11 0	3 10 0	3 15 0
1½ and 2-inch Socket-pipes	7 0 0	5 15 0	5 10 0	6 0 0	7 0 0
2½ and 3-inch ditto	6 10 0	5 5 0	5 0 0	5 15 0	6 10 0
4 and 5-inch ditto	6 0 0	4 15 0	4 10 0	5 5 0	6 0 0
6 inches and upwards ditto	5 15 0	4 5 0	4 0 0	5 0 0	5 15 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 5 0	5 0 0	5 10 0
Ditto, 2nd ditto, cold ditto	6 10 0	—	—	—	6 10 0
Tank-plates, ¼ thick and above	6 0 0	5 0 0	4 15 0	5 10 0	6 0 0

WROUGHT-IRON TUBING,

Subject to 60 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 14 feet—per foot	1 8	1 1	0 10	0 7	0 5	0 4½
Ditto ditto, from 12 in. to 23½ in.—each	3 0	2 0	1 6	1 1	0 9	0 8
Long Screws, from 12 in. upwards	4 0	2 8	2 0	1 6	1 2	0 11
Bends and Springs	4 3	2 3	1 9	1 3	0 11	0 8
Square Elbows, equal or reducing; Round Elbows, 5 per cent. extra	3 9	2 3	1 9	1 3	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 9
Crosses, ditto, equal or reducing	4 8	3 6	3 0	2 3	1 9	1 6
Iron Cocks	20 9	13 0	10 0	7 8	5 0	3 8
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4½
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	15 0	14 0	13 6	13 0	12 0	—

FREIGHTS.

Coastwise—Newcastle:—	Per Ton. s. d.	*Foreign:—*	Per Keel.
Chatham and Rochester	8 0	Barcelona	£22 10s
Cork	8 0	Bordeaux	10 0
Dover, Folkestone, and Ramsgate	6 0	Boulogne and Calais	7 10
Dublin	8 0	Cadiz	16 0
Exeter Quay	7 0	Cronstadt	9 10
Ipswich	5 6	Copenhagen	8 0
London (from Leith)	5 9	Genoa	17 10
London (Pool)	5 9	Hamburgh	8 10
Lowestoft and Yarmouth	5 0	Havre de Grace	8 0
Portsmouth & Southampton	7 0	Leghorn	17 10
Plymouth	8 0	Lisbon	13 0
Shoreham	7 0	Rotterdam	8 0
Whitstable	5 0	Stettin	9 10
Weymouth	7 0	Trieste	19 10
		Venice	21 0

SUNDRIES.

Best Newcastle Fire-bricks, per 1000	£2 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley), per 1000	2 15 0
Ingham's ditto (at Wortley), per 1000	2 15 0
Farnley Iron Co.'s Fire-bricks (at Wortley), less discount	2 17 0
Fire-clay Retorts, per foot run	5s. 6d. to 0 7 6
Tarred Rope Yarn, per cwt.	1 0 0

GAS COALS.

Newcastle—Unscreened:—	Per Ton 6s. 6d.
Haswells, Nettlesworth Primrose, and South Pelaw	
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	7 6
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7 0
Pearcth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Pearcth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	17 6
Wigan Cannel (at Liverpool)	17 0

Scotch Cannel, f.o.b.:—	Per Ton.	*Scotch Cannel*, f.o.b.:—	Per Ton.
Boghead—at Bo'ness, 47s. 6d.; at Leith 48s. 2d		Arniston (at Leith)	21s. 0d
Muirkirk	27 0	Wemyss (at Wemyss)	20 0
Kirkness, best (at Burntisland)	29 6	Haywood Co.'s Haywood (at Granton)	21 0
Capeldrae, 1st quality (at ditto)	22 6	Firnie, or Methill	17 0
Ditto, 2nd ditto (at ditto)	17 6	Lothian's Cannel (at Leith)	24 6
Cowdenbeath (at ditto)	12 0	Grange ditto (at Bridgeness)	17 6
Loshgelly (at ditto)	12 0	Kinniel ditto (at Bo'ness)	17 6
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6	Myles' ditto	23 6
Auchinheath Lesmahago (at Granton)	27 0	Lochore Parrot (at Burntisland)	25 0
Duke of Hamilton's Lesmahago (at Granton)	27 0	Waverley Seam (at do.)	16 0
		Lanemark (at Glasgow)	16 0
		Elphinstone Tower (at Leith)	20 0

WEEKLY METAL REPORT.

(From J. Berger Spence & Co.'s Circular.)

Iron.—"Ayresome" Yorkshire pig iron likely to be higher. Present prices—No. 1, 52s.; No. 2, 50s.; No. 3, 48s. 6d.; No. 4 (foundry), 47s. 6d.; No. 4 (forge), 47s. 6d. net cash, or 1s. extra four months. Scotch pig steady, at 57s. 9d. to 58s. Welsh bars, £6 15s. to £7. Staffordshire bars, £7 10s. to £8. Hoop iron, £8 10s. Gas-tubes, 60 per cent. to 67½ per cent. off list. Boiler-tubes, 40 per cent. to 42½ per cent.

Copper is again firmer. English tough ingot, £76. Chili bars, £67 15s. to £68.

Tin.—In good demand. English ingot, £135 to £136. Straits, £132 10s. to £133.

Tin-plates.—Coke, I.C., at 24s. to 25s. Charcoal, I.C., 28s. to 30s. per box.

Lead.—Unaltered. Best English soft pig, £18 5s. to £18 10s. Red lead, £21 to £22.

Antimony.—French Star, £49 to £50.

Spelter is again quiet. Silesian, special brands, £18 7s. 6d. to £18 10s. English, £18 10s. to £19.

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LESMAHAGOW

CANNEL COAL.

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BECKTON WORKS

OF THE

CHARTERED GAS COMPANY,

WITH

SEVENTEEN SELECTIONS FROM THE WORKING DRAWINGS,

PREPARED BY

F. J. EVANS, Esq., M.I.C.E.,

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A few copies of the letter-press description may be had apart from the Drawings, price 2s. 6d., by post 2s. 8d.

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WANTED, by a respectable Man, aged 40 (no incumbrance), a situation as MANAGER of Gas-Works. Well acquainted with the manufacture and distribution of gas, main and service laying, fittings, and meters, &c. Prefers going abroad. Unexceptionable references from present employer.

Address Geo. Harding, Gas-Works, Broad Green, Liverpool.

WANTED, by an Engineer of considerable experience in the fitting up of Gas-Works, and who can be well recommended by several Gas Managers and Gas Engineers, a situation as GAS MANAGER.

Address A. Z., care of Mr. Fleming, Gas-Works, Lancaster.

GASHOLDER AND TANK FOR SALE.

THE Directors of the Croydon Gas Company have FOR SALE for £550, as it stands on the Company's premises at Pitlake, Croydon, a TELESCOPIC GASHOLDER and Wrought-Iron TANK, 80 ft. diameter, with 12 columns, girders, inlet and outlet pipes, syphons, and two valves.

The gasholder is now in use, and can be seen, and further information obtained, on application to Mr. C. Farrand, Manager, Gas-Works, Waddon, Croydon.

By order of the Directors,

W. J. Russell, Secretary (*pro tem.*).

Offices, 23, George Street, Croydon, June 29, 1871.

WANTED, by a young Man, a situation as Meter Inspector, Fixer, Fitter, &c. No objection to go abroad.

Address P. P., care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a young Man, an engagement as SECRETARY and MANAGER. Is well acquainted with the manufacture and distribution of gas, main and service laying, fitting, and meters; well up in accounts and collecting. First-rate testimonials.

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WANTED, a respectable married Man as INSPECTOR, and to take charge of works, office, stores, time, &c. He must write a good hand, give satisfactory references, and state present employment. Wages 30s. per week, with small house on the works, coal, gas, &c., free. Persons without family will be preferred.

Address the Engineer, Gas-Works, South Shields.

GAS Engineer and Foreman of experience WANTED in a large and old established gas and hot-water fitting business. Must be of gentlemanly address.

Apply by letter only, stating full particulars, to H. S., care of Cossart, Gordon, and Co., 75, Mark Lane, E.C.

WANTED, immediately, a Working FOREMAN for the Gas-Works, Newton-in-Mackerfield, Lancashire. He must thoroughly understand making and purifying gas, laying mains, services, and all other details of a Gas-Work, including indices, repairs of meters, public lamps, as well as plumber's services, &c., for water supply. The situation is permanent to a steady, experienced person. Wages 28s. per week, with house, gas, and coals free on the works.

Applications, with particulars, to be made to Richard Brierley, Engineer and Surveyor.

Town-Hall, July 15, 1871.

MODERN STREET LIGHTING, by William Sugg, A.I.C.E., price 1s. 6d., is now ready, and will be forwarded post free for 19 stamps.

W. Sugg, Vincent Works, Vincent St., Westminster, S.W.

WANTED, a situation as Improver to a Gas-Fitter, or in a Gas-Work, by a lad aged 15 years. Has had four years experience.

Apply, stating terms, &c., to F. Taylor, Gas-Works, Sturminster, Newton, Dorset.

WANTED, at the Gas-Works, Erith, Kent, two steady and industrious Men as STOKERS. A reference will be required. Wages 28s. per week.

Apply by letter only to the Manager at the Works.

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GASHOLDERS, TELESCOPE AND SINGLE-LIFT,

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WANTED, an active, intelligent Man, to take the sole Working MANAGEMENT of the Billingboro' and Horbling Gas-Works. He must thoroughly understand the laying of mains and services, fixing meters, &c., and must be prepared with testimonials as to character and ability. Salary 25s. per week, house, coals, and gas found.

Apply, stating full particulars, to the Secretary, Mr. W. E. CHAPMAN, Solicitor, Horbling, FALKINGHAM.

Horbling, July 11, 1871.

FOREMAN OF GAS-WORKS.

WANTED, by the Shrewsbury Gaslight Company, a steady, respectable married MAN, without children, to reside on the works. Wages 30s. per week, with cottage, coal, and gas.

Applications, stating age and qualifications as to character and fitness, to be sent to me on or before the 12th of July next. S. B. DARWIN, Secretary and Manager.

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THE Advertiser is open for an engagement as MANAGER, to enter on duties after September next. He has now the management of a Gas-Work where the make of gas is over 30 millions annually.

Apply to A. D., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Advertiser, aged 23, of energetic business habits and good address, with six years experience, desires an engagement as CLERK or ASSISTANT MANAGER. Unexceptionable testimonials.

Address A. C. LE HURAY, Gas-Works, GUERNSEY.

GAS-METER MAKER.

A Repairer and Prover wants Employment at a Gas-Work. Provincial preferred. Good references.

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ON SALE, a good second-hand StationMETER, 8000 feet per hour, West and Gregson make, bye-pass, &c.

Apply to W. LONGWORTH, Gas Offices, Dukinfield, MANCHESTER.

FOR SALE, one Cockey's Patent 10-in. Centre-Valve for four purifiers; One Carter's Patent 10-in. Valve; Six ordinary 10-in Flange-Valves; Six Purifier-Lids, 8 ft. by 8 ft.; and Two Jib Cranes; the whole of which have been in use only a short time, and are nearly equal to new.

Apply to J. HEPWORTH, Gas-Works, CARLISLE.

FOR SALE CHEAP, a set of Three PURIFIERS, 5 ft. by 5 ft., inside measure, with travelling crane and lifting apparatus complete, with one of Cockey's centre-valves and 5-in. connexion.

The above are good, but too small for present consumption.

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Apply to the BRYMBO COMPANY, near WREXHAM.

TO GAS COMPANIES AND OTHERS.

FOR SALE CHEAP, a Condenser, consisting of cast-iron box, 9 ft. long, with 10 ft 4 in. sockets cast on top; 10 ft. 4 in. upright pipes, 9 ft. long; and semicircle bends complete.

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One 2500 feet per hour, to be seen at the Gas-Works, Lurgan, Ireland.

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FINE CAST-IRON BORINGS always in stock.

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Scrap Iron taken in exchange.

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THE Directors of the Birmingham Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR manufactured at their Windsor Street and Fazeley Street Works, Birmingham, for a term of Three or Five years.

For particulars, apply to Mr. Edward White, the Company's Engineer, Windsor Street Gas-Works.

The Directors do not bind themselves to accept the highest or any tender.

Tenders to be sent in on or before the 22nd inst., addressed to the Chairman of the Company, and endorsed "Tender for Ammoniacal Liquor."—By order,

JOSEPH SLOCOMBE, Secretary.

TO TAR DISTILLERS.

THE Directors of the Independent Gaslight and Coke Company are prepared to receive TENDERS for the TAR produced at their works, at Haggerston, for One year, from the 31st of July, 1871.

Tenders to be sent to me, on or before Thursday, the 27th day of July, endorsed "Tender for Tar."

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JAMES B. COULSON, Secretary.

236, Kingsland Road, July 4, 1871.

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GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

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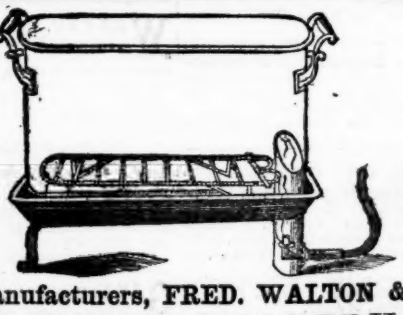

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Prices, with Enamelled Pan complete—No. 1, 11s.; No. 2, 16s. 6d.; No. 3, 25s.

Discount to the Trade on application.

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THE Electric Telegraph Department of our business is most efficiently conducted by an experienced staff. CONTRACTS entered into for maintenance and erection of lines for Gas and Water Companies, private residences, hotels, steamships, &c. Bailey's simple A B C instrument is stronger and less liable to derangement than any other in the market.

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JOHN BAILEY AND Co., Turret Clock Makers to the late Earl of Rosse, the British and Foreign Governments, &c., Electric Telegraph Engineers, and General Brassfounders, Albion Works, Salford, MANCHESTER.

TO BE SOLD, at the Rhyl Gas-Works, North Wales, 23 15-in. Mouthpieces for Clay Retorts, ascension-pipes, hydraulic main, and delivery pipes complete. One set of 8-in. double vertical Condensers. One Station-Meter (Bent' and Co.), with valves and connexions complete, to pass 4000 feet per hour. Four sets of Purifiers, respectively 6 ft. by 3 ft. 6 in., 4 ft. by 5 ft., 4 ft. by 4 ft., with connexions, &c., complete. Large lot of cast and wrought iron, comprising the interior Fittings of a 10,000 feet Gasholder; and sundry other materials.

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Balance-sheets prepared, Accounts audited, Consultations, Agencies, &c.

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Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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CAST-IRON Retorts, Socket-Pipes, with Syphons, and all requisite Connexions, Lamp Columns, Wrought-Iron Tubing, Valves, Street-Lamps, Sight Holes, Furnace Doors, Ash-Pans, Charging and Coke Shovels, Iron Pails, Coke Barrows, Cross Bars, Fire Pots, Pumps, and Iron Borings.

PURIFIERS, CONDENSERS, & SCRUBBERS erected complete, or the materials supplied; and every description of goods in use by Gas-Works, in stock, at wholesale prices, at

Mr. LYNCH WHITE'S,
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BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON. Agents wanted.

EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

"21, *Parliament Street, Westminster, S.W., Nov.* 5, 1870.

"Dear Sir,—I had occasion to visit a country gas-work, which at the present time is being remodelled under my direction, and found the only available Retorts in such a state as the word 'desperate' only feebly describes, carbon having been deposited in many of them to the extent of about 5 ft. in length, in solid blocks of 15 in. diameter. The works under these circumstances being only able to produce about half the gas required for the town. I need not explain how such a state of things had come to pass; it is enough to say I had to deal with it. I applied Edge's patent process, which I have to thank you for bringing under my notice a few months since, and you will be glad to hear that perfect and complete success resulted from its application.

"I believe I am acquainted with all the known methods of dealing with this question of the removal of carbon from the interior of Retorts, but I am quite satisfied that no other than this would have enabled me to save the town in question from darkness. I feel that it is due to you and the patentee to call the attention of gas managers to the invention, which I regard as a boon beyond all praise.

"The Clay Retorts upon which I operated were nearly worn out, and, but for this method of dealing with them, would have been rendered totally useless, whereas they are now doing good service, and working off full charges at good heats.—I am, dear sir, yours faithfully,

"E. Goddard, Esq." "R. P. SPICE.

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to
E. BAKER AND Co., LATE BRIERLEY HILL, STAFFORDSHIRE.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
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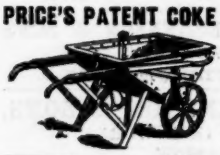

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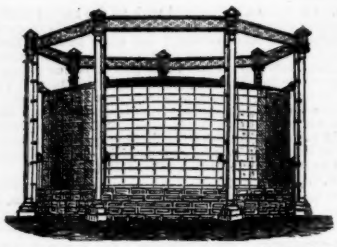

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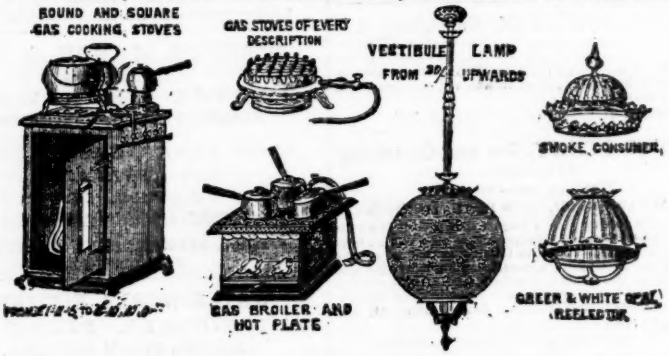
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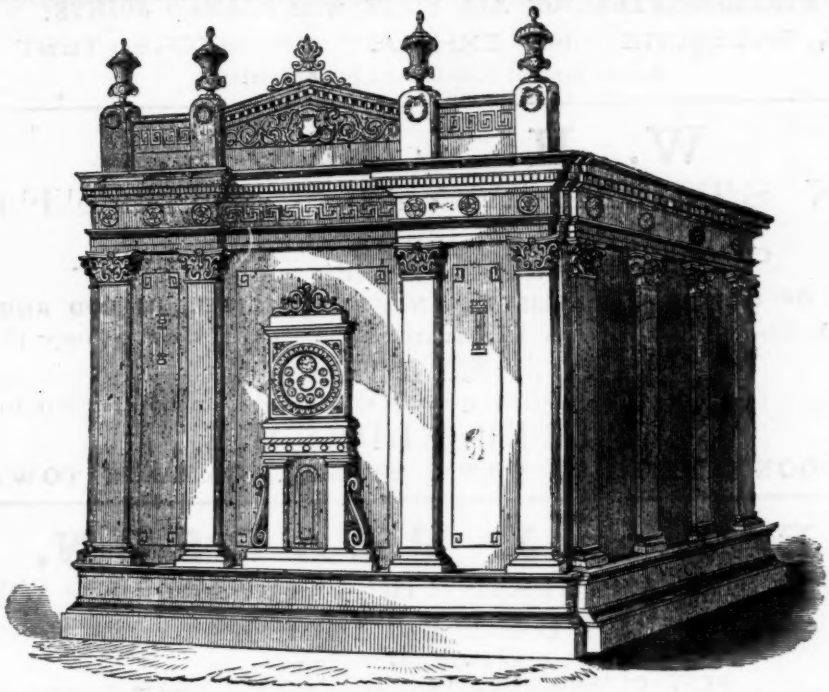

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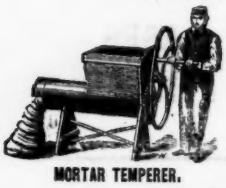

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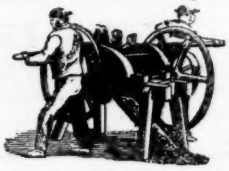

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We are, yours most respectfully,

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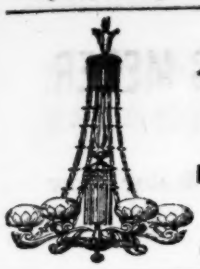

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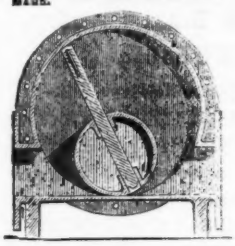

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Lochore seam	11,351	37·06	0·33	1414	52	12
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Illuminating power rather over	21 sperm candles.
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We add from the same source the capabilities of the common gas coal—

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Yield of coke	13 cwt.

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Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

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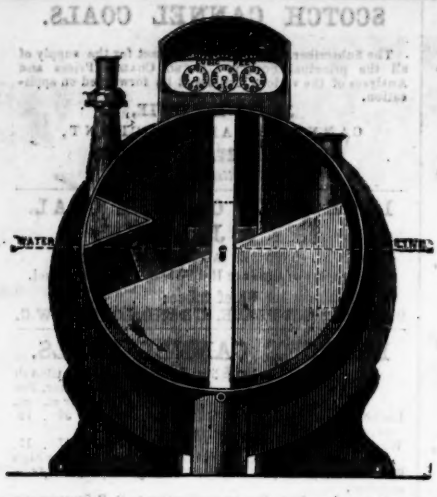

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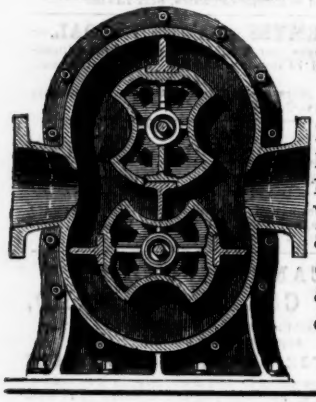

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